HT Series

CPTSND Users Guide

For the VERTEK HT Series Data Acquisition System

Revision 1.0

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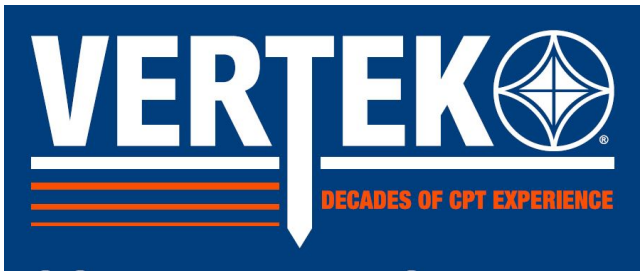
Revision	Date	Sections	Addressing	Responsible POC
1.0	May 2020	All	Update	Carl Tracy



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INTRODUCTION

The HT-0590 Field Computing System (FCS) is an advanced platform for the acquisition of Cone Penetrometer (CPT) data.

Figure 1 HT-0590 front view

The FCS allows the user to perform CPT tests with minimal effort and training. The included software, CPTSND for Windows, is designed to give the operator maximum feedback from the cone penetrometer test in a simple, readable format.

This manual is to provide the user training to operate the FCS system and CPTSND and acquisition of CPT data. It is not intended to be a guide on the proper interpretation of CPT data**.** There are many different standards for the interpretation of CPT data and an attempt to tutor the user in these standards is beyond the scope of this manual.

SECTION 1.0 SYSTEM SETUP

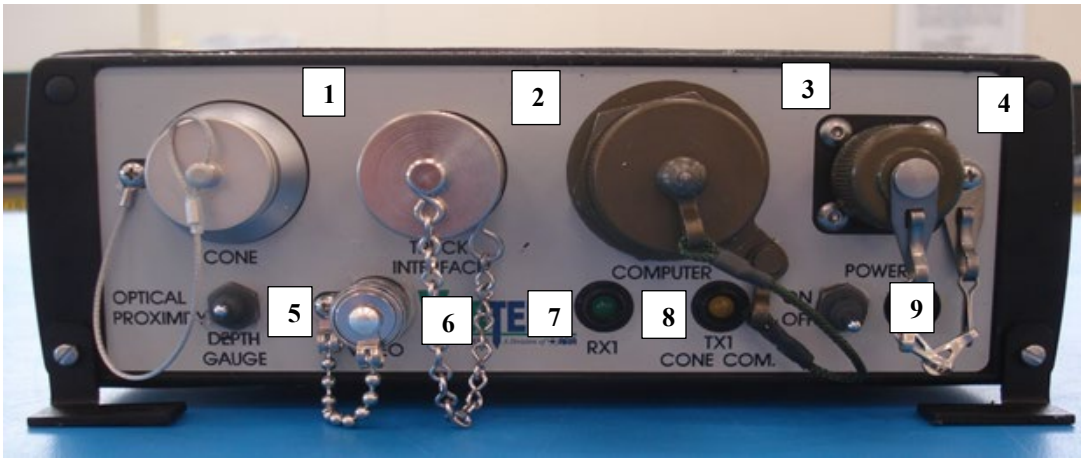


Figure 2 HT-0590 Connections

Setting up the FCS is simple. There is only one USB connection to the computer and connections numbered 1 to 4 in **Figure 2** are for the truck interface.

The four connections for the FCS are as follows: (1) the cone cable, (2) the 19 pin truck interface connector, (3) computer USB communications cable and (4) FCS power supply. All 4 connections are located on the front of the FCS.

The depth gauge switch (5) is for selecting optical or proximity sensors which is system dependent.

The video connection (6) is only used with vision module.

The RX1 LED (7) indicates cone data is connected and transmitting and the TX1 LED (8) indicates the FCS DataPack (DP) is transmitting to the cone.

The ON/OFF switch (9) and LED provides power to the DP and cone.

The four connectors to the truck interface are located on the yellow junction box. They are as follows:

(1) Depth counter; (2) head-load and pressure switches (HL/P); (3) Seismic trigger; (4) Solenoid switch output (for user integrated stop function). The 19 pin cable from the DP connects to large connector (5) on the bottom of the yellow box

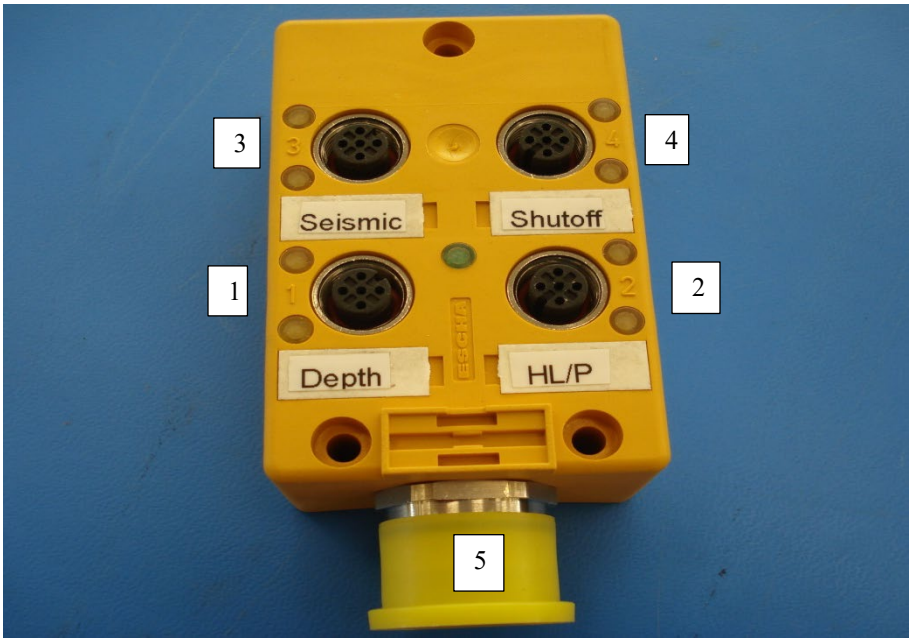


Figure 3 Truck Interface Connections

They are labeled on the junction box. If the labels wear off, there are numbers that are etched on the box that correspond to the switches: 1-DEPTH, 2-HEAD-LOAD/PRESSURE, 3-SEISMIC and 4-PUSH SHUTOFF

The interface box may have unused connections, depending on the pushing platform setup. They are described below. NOTE: Some of the switches and cables described below may not be present, depending on the setup of the direct push platform. Only the depth counter is absolutely necessary to perform a sounding.

DEPTH -The depth counter is on the ram set or on a ground mounted depth wheel, depending on the setup of the pushing platform. One end of the depth counter cable plugs into the interface box and the other end plugs into the depth counter. The depth counter can be a proximity switch or an encoder. If the depth counter is a proximity switch then the other end of the cable is a male molded connector that plugs into the proximity switch. If the depth counter is an encoder, then the other end of the cable is a multi-pin military style connector that plugs into the encoder

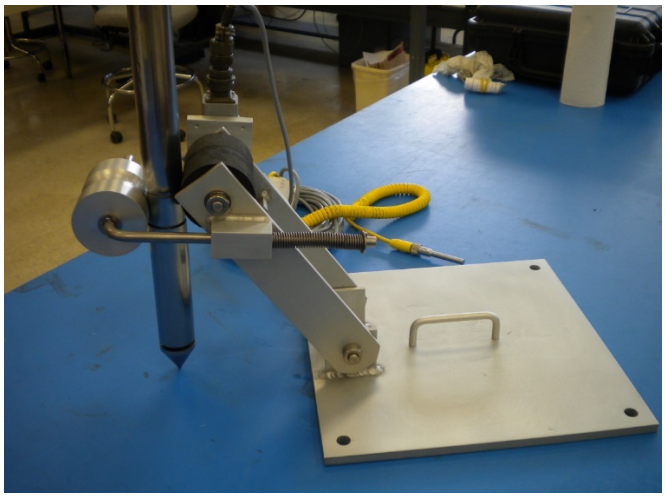


Figure 4 Ground mounted depth wheel with encoder.

Figure 5 Depth Gauge string model

HEAD-LOAD/PRESSURE -The head-load (clamp) and push pressure switches are located on the clamp and the hydraulic handle, respectively. One end of the cable plugs into the interface box and the other end plugs into a splitter. The other end of the splitter has two connectors. The individual cables for the head-load or pressure switch plug into the other end of the splitter. The coiled cable plugs into the head-load switch on the clamp and the other cable plugs into the pressure switch on the hydraulic handle. **(NOTE**: Many systems run with only a proximity switch on the mechanical clamp or a pressure switch on the hydraulic clamp)

SEISMIC -The seismic trigger is mounted on the strike plate; for multiple triggers a selector switch is available so that multiple triggers can be connected to account for different angles to the cone. Older systems will have a wired hammer with a junction box for connections.

Note: The seismic splitter on older systems is NOT interchangeable with the head load/pressure splitter above.

PUSH SHUTOFF –The push shutoff solenoid switch is mounted on the hydraulic system. This switch will be connected to a grey metal box. There are two other cables that come out of this box. One cable will have two conductors which go to the 12 Volt power. The other cable has a molded connector that plugs into the interface box.

1.1 INSTALLING THE SOFTWARE

Find the CPTSND installer (either on the installation disc or via download from vertekcpt.com). Double click on the installer for CPTSND and follow the standard prompts (be sure to create a desktop short cut).

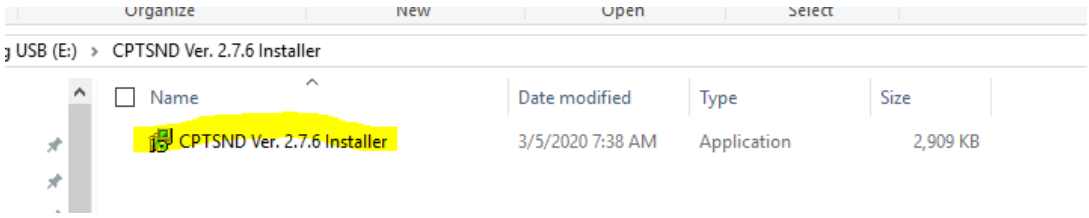


Figure 6 Software Installer

CPT SND does require that the computer have a current version of Windows .Net software and most modern computers have this already loaded. If the need for it is detected you will be prompted to install. This is easily sourced for free downloading on the internet (https://dotnet.microsoft.com/download/dotnet-framework/net35-sp1).

It is also necessary to install device drivers for the USB communications device in the HT-0590. Simply install the proper version of CDM21228 setup for your computer (https://www.ftdichip.com/Drivers/D2XX.htm) to satisfy the need for most systems. Occasionally it will be necessary to supply other drivers and VERTEK has generic DRIVERS folder for download when needed.

1.2 SETTING UP THE SOFTWARE

The software will be only partially setup when initially installed on your computer. There are a few changes that need to be made by the user, such as the desired channel units.

To setup the software, start the computer and double click on the CPTSND icon (older systems may have DIGITAL CONE icon). This brings up the startup screen.

Figure 7 CPTSND Initial Screen

For the HT series cones the screen should look like the above with DETECT HT DAS in the lower right corner. If this is not the case then click on specify system type and select HT Series.

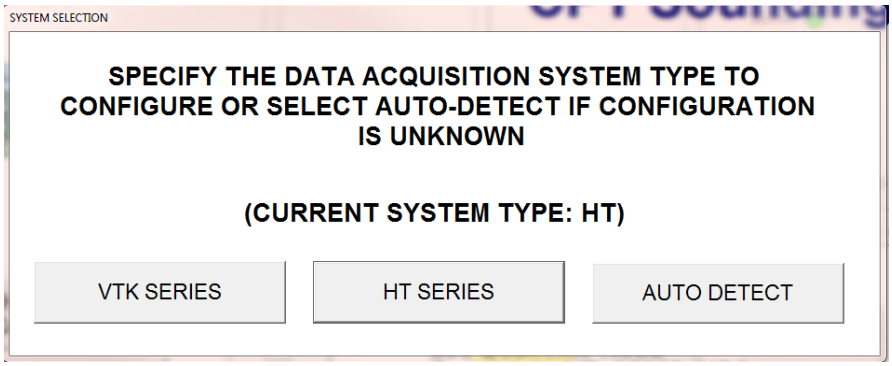


Figure 8 System Selection

This brings up the main setup screen below

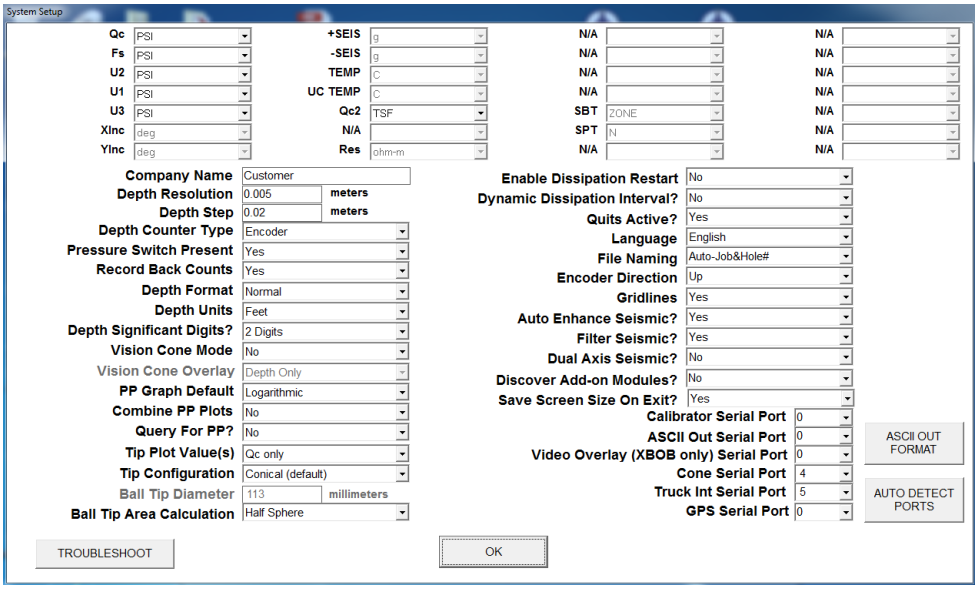


Figure 9 SETUP Screen

To change any of the settings, click on the drop-down box for that setting, if there is one, or enter the data directly if there is no drop-down box. The settings are described below:

Display Units - display units for the test are chosen in the top section, use the drop downs to choose

Company Name - enter the company name to be on the files

Depth Resolution - this setting determines the software response to each pulse from the depth marker. Most newer systems use 5 mm per pulse (displayed as 0.005 m). Some older systems using a proximity switch on a wheel or gear may use 5 cm or 2 cm increments (displayed as 0.05 or 0.02m)

Depth Step – this setting determines the distance between readings that get stored in the data file. Most

users set this to every 5 cm or 2 cm (displayed as 0.05 or 0.02m). NOTE: the DEPTH STEP must be a multiple of the Depth Resolution setting. Readings too close together can cause program to hang up and miss data points. For this reason VERTEK recommends setting depth step no smaller than 1 CM (0.01)

Depth Counter Type – Set to match your equipment, either proximity or encoder. The encoder setting will allow the program to use the direction of movement of the encoder while in the proximity setting the encoder will simply count depth in either direction. Encoders will function in either setting but the encoder position aids in preventing depth from being counted while raising the rods or clamp.

Pressure Switch Present – Normally set to NO unless there is a pressure switch and clamp switch present. (some systems use both and many just use a clamp switch)
Record Back Counts- used in specialty applications like ball tip if it is desired to see the same section more than once (this only works with encoders) Set to **NO** for all standard CPT operations.
Depth Format – Normal will count depth as a positive number based on rod travel. The Elevation setting will have the test start at a user entered elevation and test will count down from that setting.
Depth Units - Select Meters or Feet
Depth Significant Digits – Enter the desired number of digits to display to the right of the decimal point.
Vision Cone Mod/Vision Cone Overlay – Not normally used, grayed out
Pore Pressure (PP) Graph Default - Set to Logarithmic or Linear (user preference)
Combine PP Plots - Only used if a cone has two PP gauges (very rare) Set to **NO** for standard use.
Query for PP - System will ask after cone is found to identify the PP position, useful if you switch between U1 and U2 positions but most users will enter **NO** here.
Tip Plot Values - Select Qc only or Qc and Qt (user choice)
Tip Configuration - Standard tip is Conical (default) Some users employ a ball tip for very soft materials
Ball tip Diameter- enter diameter of Ball Tip if used
Ball Tip Area Calculation - Select Half sphere or Cross Sectional (full area)
Enable Dissipation Restart – No will remove the restart option from the dissipation screen. This option is only used for research that involves dissipation while cone is moving and is controlled from the dissipation screen if YES is selected.
Dynamic Dissipation Interval – A **NO** selection will have the DIS file record the PP every second until the test is stopped. (this can make a very large file in long tests) a **YES** selection will record PP at increasing intervals to keep file size down (see dissipation test guideline)
Quits Active - YES will allow the system to generate warnings based on the ratings for the cone found or for inclination total or rate change.
Language - English is the only language at this time

File Naming – dropdown has three choices: **Manual** (user needs to enter file name on every test), **Auto-Increment** (once a file name has been entered the system will add 001, 002 etc to subsequent tests, and **Auto-Job & Test #** will automatically enter the file name based on header information entered on test.

Encoder direction – Select either UP or DOWN so that data is recorded while pushing. Selecting encoder enables the system to use the directional feature of the encoder to ignore data when moving the wrong way. This setting will selection will depend on how the encoder is mounted.

Gridlines – For the graph display during test select either Yes or No

Auto Enhance Seismic – **YES** will amplify a weak signal during a seismic test so the operator can see it

Filter Seismic - **YES** will automatically clean up a weak signal to avoid false data

Dual Axis Seismic - Normal operation would set to **NO**, so operator can choose better geophone on first strike. **YES** will cause both geophones in a dual S wave cone to be recorded.

Discover Add-on Modules – Default this setting to **NO** to only look for the cone and speed up the process. **YES** allows the system to search 10 channels for any additional items that may be attached.

Save Screen Size on Exit – **YES** allows the screen to save placement and size, very handy if you monitor something else on the screen during CPT testing.

Calibrator Serial Port - Not applicable for most users, this is the internal serial port an external calibrator (load cell) is attached to:

ASCII Out Serial Port - not normally used

Video Overlay Serial Port - not normally used
Cone Serial Port -This is the internal serial port the cone is attached to.
Truck Int Serial Port -This is the internal serial port the truck interface is attached to on the FCS. Follow the screen instructions to auto configure the proper port numbers.
GPS Serial Port -If a GPS receiver is attached to the computer, the serial port it is attached to is entered here.
After setting up the software, press OK to return to the STARTUP SCREEN

SECTION 2.0 SETTING UP A SOUNDING

Once the hardware and software are setup, it is possible to start a sounding.

Plug in the four connections to the FCS: (1) truck interface, (2) truck interface power, (3) cone and (4) computer power. Plug the other end of the cone cable into the cone.

Turn on Power to the HT-0590 and computer and click on the CPTSND (or Digital Cone) icon. Click on the DETECT HT DAS button. The computer will show the following pop-up window:

Figure 10 Looking for Cone

This window will stay up for 1 to 10 seconds. If it does not disappear after 10 seconds then check the connections, especially the cone cable (both ends) and the truck interface (19 pin cable) connections.

Also, make sure that the 12 Volt power for the inverter or the generator is on. If the unit is powered properly there will be a green LED on in the center of the yellow truck interface box. If the problem persists, reseat the cables and verify that that the CPT datapack device is found by checking in your computers DEVICE MANAGER, ports COM LP&T, signifier would be USB to serial adapter, followed by COM # if connected. If not Connected, there will be nothing identified in COM LP&T.

When the computer finds the cone, the CONE SETTINGS screen will appear:

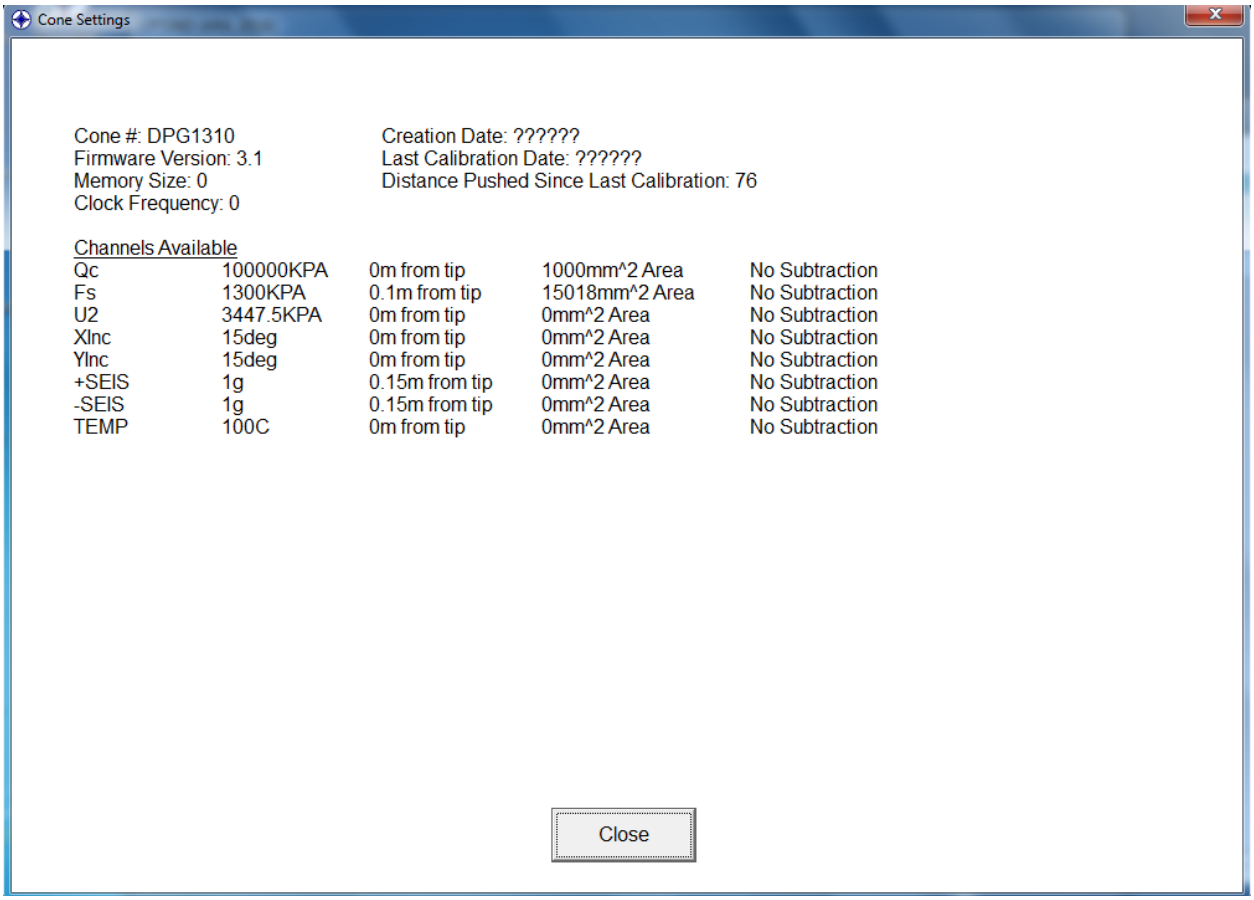


Figure 11 Cone Settings

This screen shows the cone settings, including the cone #, the cone channels and the channel capacities. The other information is for future expansion, including the distance pushed and the calibration date.

Press **CLOSE** to go to the next screen. The next screen is the **SOUNDING SETUP** screen (**Figure 5**). All of the header information is entered on this screen. All of the headers are self-explanatory and can be changed later using Cleanup.

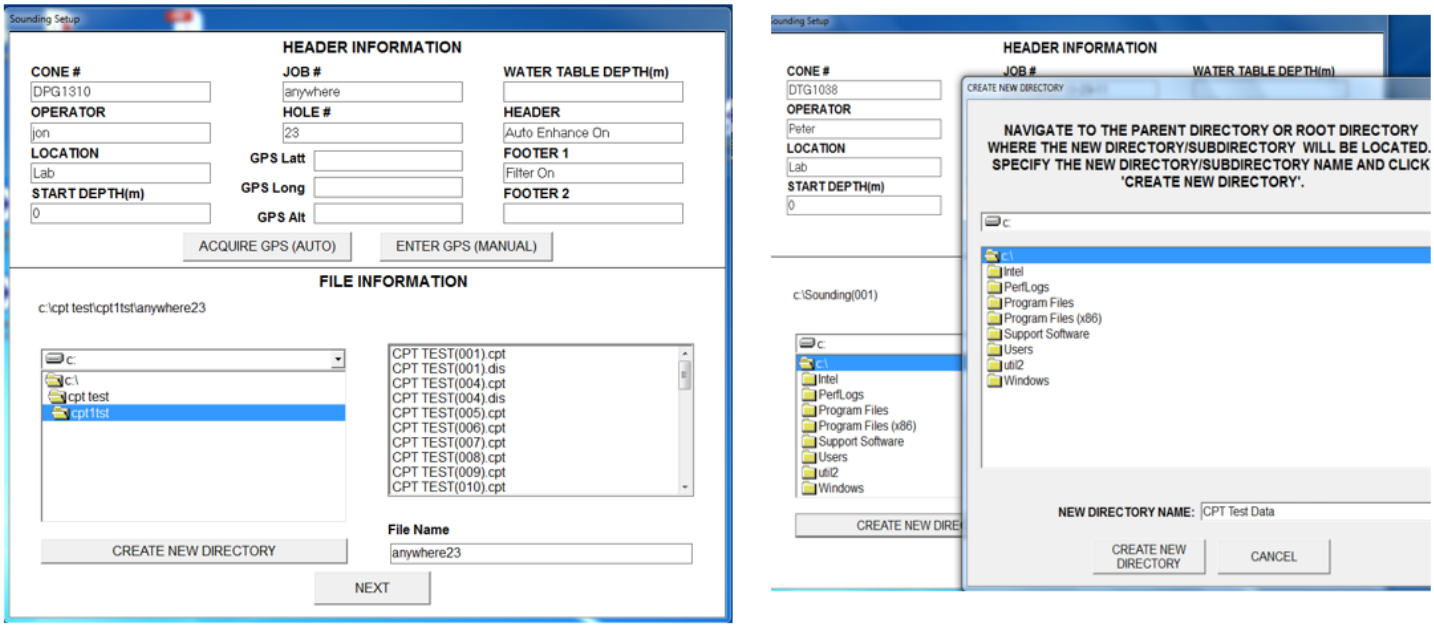


Figure 12 Header Information/File locations

If a GPS receiver is attached and properly setup, then press **ACQUIRE GPS** to acquire the GPS data. If **GPS NOT FOUND** is displayed, then check the setup of the GPS and the connection to the computer. GPS data can also be entered manually by **ENTER GPS** coordinates.

Use the drive and directory boxes on the lower half of the screen to navigate to the directory where the data is to be stored. New directories can be created on this page for ease of data storage.

Enter the File Name in the File Name box. If the File Naming setting is Auto Job and Test or Auto Increment, then the program will have chosen the file name automatically. However, the filename can still be changed manually.

Press **NEXT** to go to the next screen.

The next screen is the **Display Setup** screen:

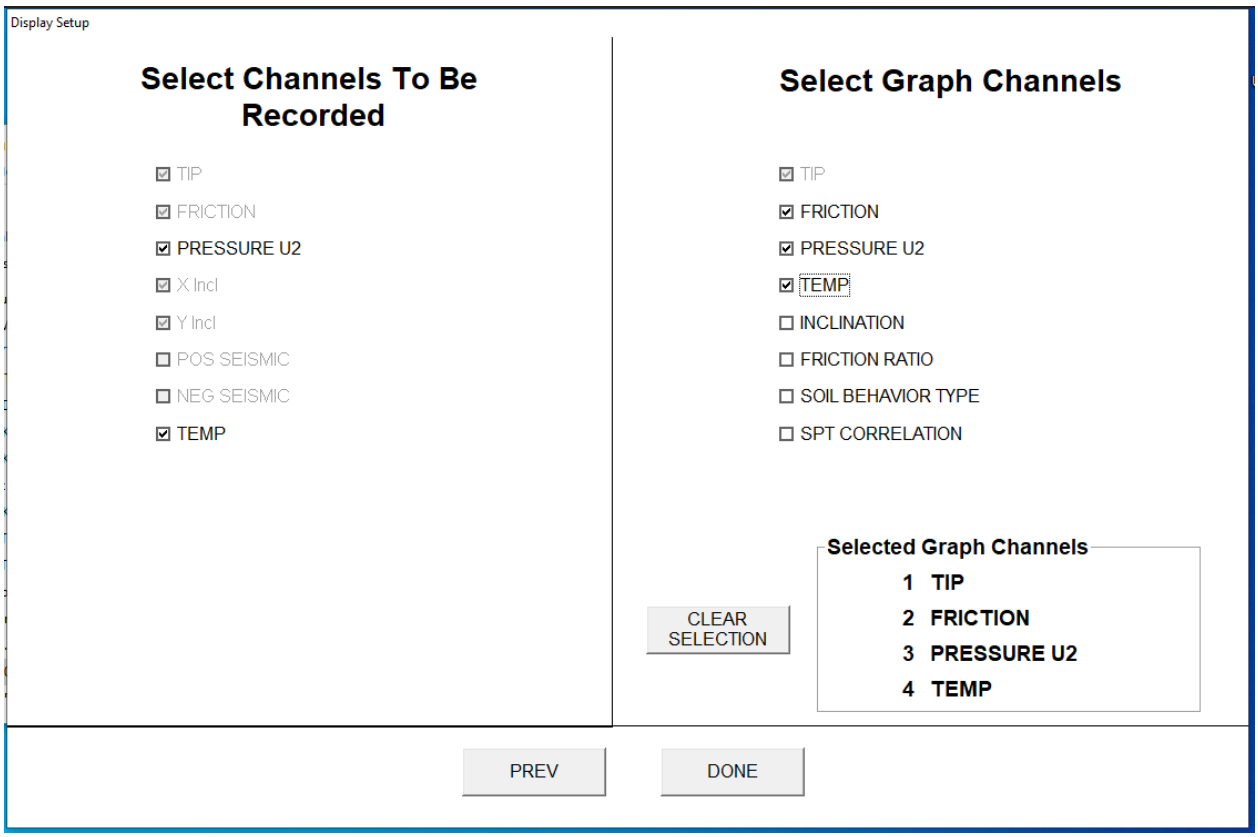


Figure 13 Display Setup Screen

On this screen, the channels that are to be recorded and graphed are selected.

The channels to be recorded are on the left side of the screen. Certain channels, if they **are** present, will always he recorded, such as TIP, FRICTION and X and Y INCLINATION. The check boxes for these channels will be automatically selected and cannot be un-selected.

Other channels, such as pressure, are automatically recorded, but can be un-selected. If a non-pressure tip is being used, pressure should be un-selected.

Some channels will not be automatically recorded, but can be selected, such as Seismic. NOTE: DO NOT SELECT SEISMIC TO BE RECORDED. This is only for troubleshooting. Seismic tests can still be performed if seismic is not selected.

The channels graphed during the sounding are shown on the **lower right half of the screen**. TIP will always be graphed and up to 4 channels total can be graphed during the sounding. It is recommended that at least **FRICTION** and **PRESSURE** are selected as additional graph channels. Some users prefer

to look at FRICTION RATIO instead of FRICTION.

Once the recorded and graph channels are selected click **DONE** to go to the main screen.

2.1 PERFORMING A SOUNDING

Once the sounding setup is completed, the main sounding screen will appear:

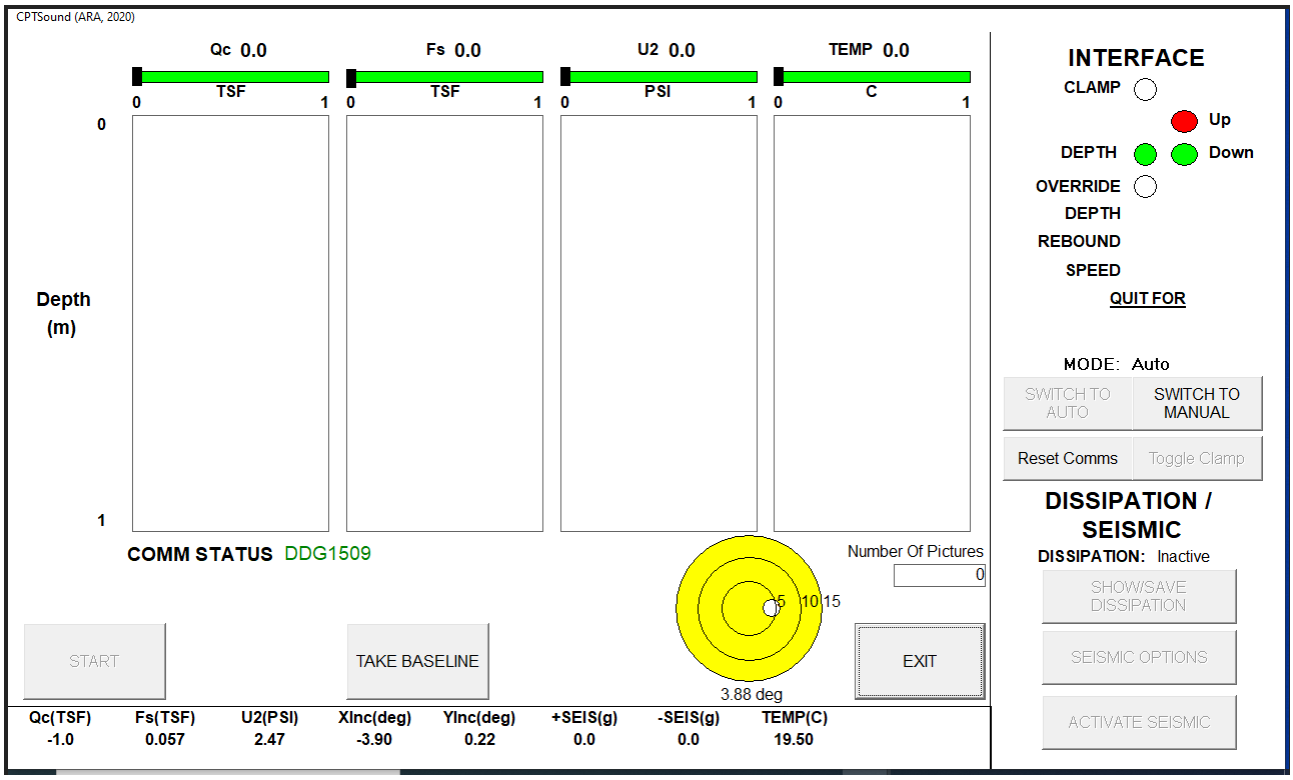


Figure 14 Main Test Screen

The graphs that were selected in the DISPLAY SETUP screen are displayed in the center of the screen. They will not display any data until it a sounding is started. The INTERFACE portion of the screen in the upper right comer shows the status of the truck interface switches. If a switch is ON then it will be green, otherwise it will be blank. **Figure 7**, above, shows a truck interface that is using a proximity switch for the depth counter. While using the encoder, if it appears that depth is recording with the rods moving up, change the ENCODER DIRECTION in the SYSTEM SETUP screen. Remember that DEPTH will only be recorded if the CLAMP indication is GREEN.

The bottom of the MAIN SCREEN shows the real-time values of the channels and the position of the inclinometer. The channel values are in the display units selected in the SYSTEM SETUP screen. The inclinometer position is displayed by the bubble in the yellow level. If the cone is standing up straight,

then the bubble should be in the center of the bubble level.

Select TAKE BASELINE to zero the channels. Make sure that a properly prepared cone is suspended vertically off of the ground when TAKE BASELINE is selected, to ensure that there is no load on the tip. If a clamp is used, place the cone and the first rod in the clamp and then click TAKE BASELINE. Some channels, such as the X and Y inclinometer channels do not zero when TAKE BASELINE is clicked.

TAKE BASELINE can be clicked as often as desired. Some cones take longer to warm-up than others. It is advisable to click TAKE BASELINE when the MAIN SCREEN is first displayed and then wait 5 minutes and press it again. In the meantime, the cone can be placed in the clamp and the pushing platform prepared for the sounding. After the baseline is taken Qc, Fs, and U2 should display zero with only minor fluctuations.

When the cone is ready to he pushed into the ground, click START. The MAIN SCREEN will change to that shown (the depth box appears and the start button turns into a stop button)

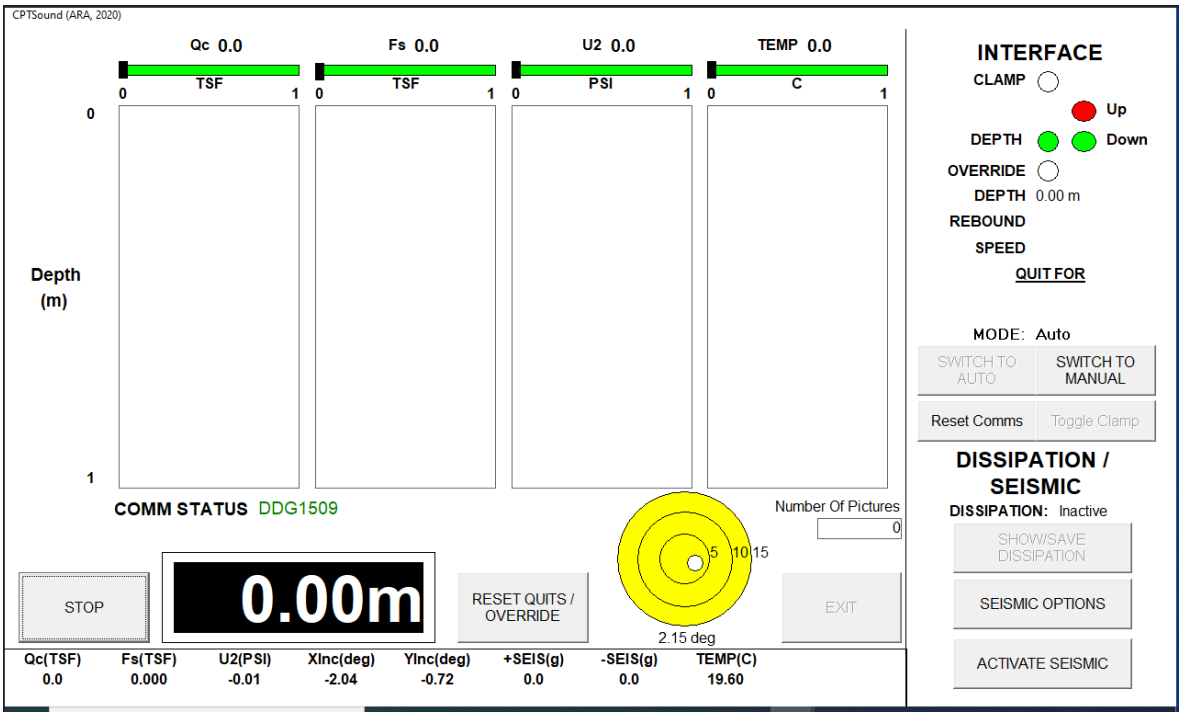
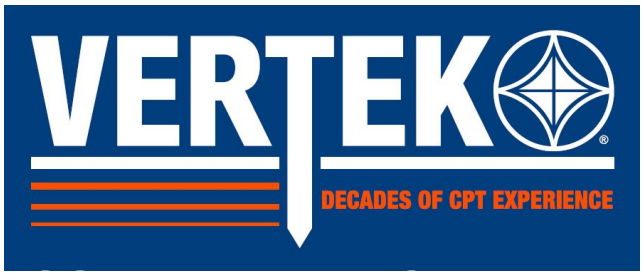


Figure 15 Test Started

The cone is almost ready to be pushed into the ground. The last step is to make sure that the interface is prepared for pushing. The following section describes the different interface configurations and the steps required to push the cone:

1. Interface with proximity switch Depth Counter, Pressure Switch and Head-load switch, if the interface has all three of these switches present, then nothing needs to be manually set to push the



cone into the ground.

2. Interface with proximity switch Depth Counter and Head-load Switch but no Pressure Switch, if the interface has a depth counter and head-load switch hut no pressure switch, then the Pressure Switch Present the setting in the SYSTEM SETUP screen should be set to NO. If it is set to NO, then the pressure switch indicator on the MAIN SCREEN will always be green and nothing needs to be manually set to push the cone into the ground.

3. If the interface has only a depth counter (proximity switch or encoder) plugged in, then the SWITCH TO MANUAL and the TOGGLE CLAMP buttons must be used to record cone data while the cone is being advanced. In a setup like this, the interface will be switched to Manual and the TOGGLE CLAMP button is used to activate when pushing and then de-activate the CLAMP indication as required when the rams are retracted to grab another rod. The mode that the interface is in is indicated on the screen just above the two buttons used to switch the mode. NOTE: DATA IS ONLY COLLECTED WHEN THE CLAMP INDICATION IS GREEN!

4. Interface with encoder Depth Counter and Head-load switch. If the interface has an encoder Depth Counter and a Head-load switch, then nothing needs to be manually set to push the cone into the ground. The AUTO function will turn the clamp indication green when the head load switch engages.

If the interface is setup properly, then it is time to push the cone into the ground. Press down on the push lever to push the cone into the ground. The depth shown in the large black box at the bottom of the screen should increase every time the depth counter turns on. If it does not, then check the interface setup. Also, the red data lines on the graphs should update every time the depth goes past the depth step distance.

This screen shows the MAIN SCREEN after the cone has been pushed **1.02** meters.

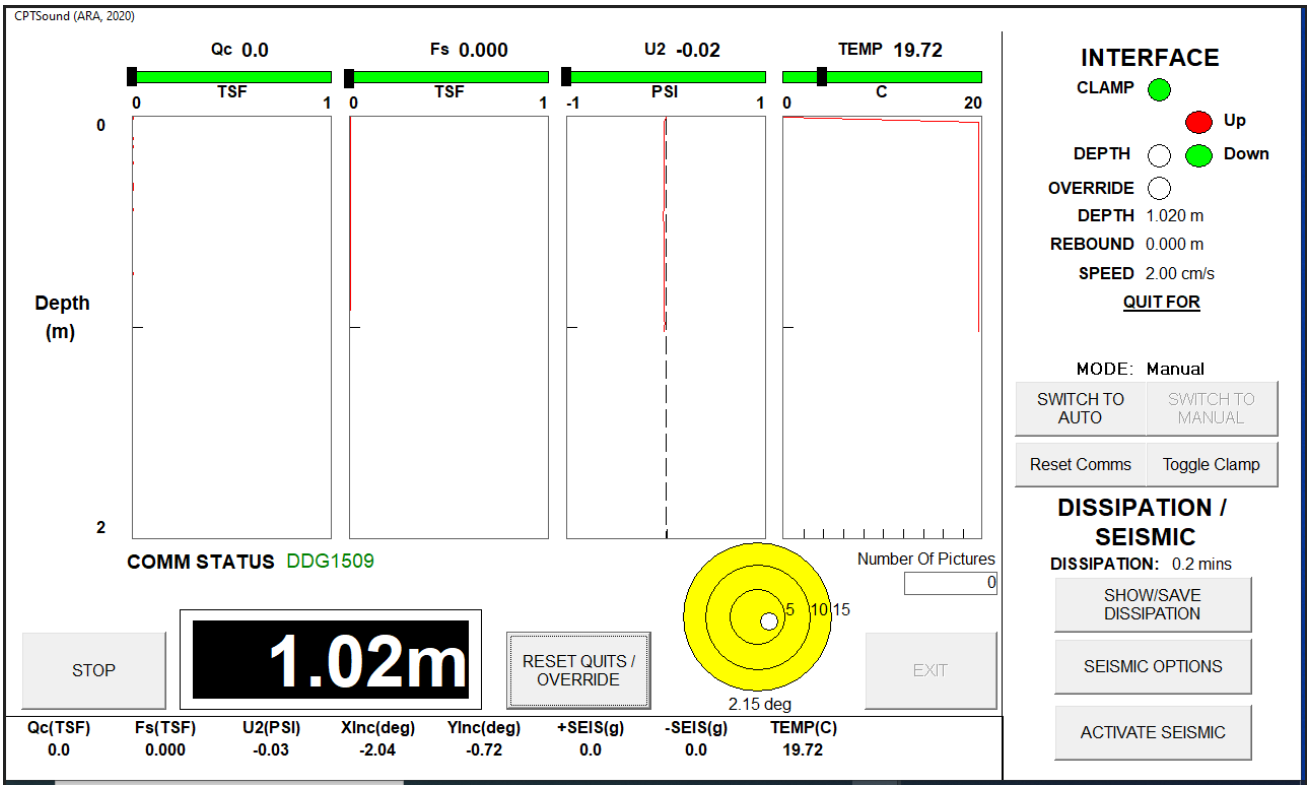


Figure 16 Test at first one meter

The data is written to the file specified in the SOUNDING SETUP screen every time the cone travels the amount specified in Depth Step in the SYSTEM SETUP screen. For example, if the Depth Step is **.05** meters, the program will write to the file every **.05** meters.

During the sounding, it is advisable to pay attention to a few things on the screen, such as **DEPTH, SPEED, REBOUND,** the live channel display, and the quits. They are explained below:

DEPTH -The depth of the sounding is normally displayed in 2 places: (1) in the large character depth display and (2) in the INTERFACE status display. If the program is being **run** in the MANUAL mode because a head-load or pressure switch is missing, remember that the clamp will need to be toggled to blank (white) before the ram is brought back up to grab a new rod. If the depth increases 2 meters for every rod, the clamp indication is probably GREEN when the rams are being brought up. Make sure that the clamp indication is GREEN only when the ram is going down and is WHITE when the ram is going up.

SPEED -The speed for the sounding should be 2 cm/sec. ASTM does allow a 10% plus /minus tolerance (1.8 – 2.2 cm/sec. range).

REBOUND – Rebound will only be measured with an encoder style depth unit and is defined as the distance the rod string travels when the pushing pressure is released. When there is no pressure, the rods

might move upward if they were bent in the ground. When pressure is re-applied, the rods will bend first and then they will move downward. To prevent the counter from recording depth when the rods are pushed back in, the computer will record rebound if a Head-load switch and a Pressure switch are present. Rebound will also be counted when the ram set is moved up to relieve rebound prior to unclamping. When rebound is recorded, it will count back to zero before the depth starts increasing (recording) again.

LIVE CHANNEL DISPLAY -The live channel readings are displayed on the bottom of the screen. These are important because they are the first indication of a problem with the cone. If the channels are not changing while the cone is being pushed, the truck interface power needs to be unplugged and plugged back in. If the channels continue to be frozen, call Vertek customer service at (800) 639-6315.

The live channel display can also be the first indication that the cone is nearing a quit condition. If the cone hits a hard layer, the live display will show it first. The graphs only update with each depth step measured.

QUITS -If the Quits Active, setting in the SYSTEM SETUP screen was set to **YES**, then the computer will monitor the channels for quit conditions. A quit condition is reached when a channel reaches 80% of calibrated pressure and a red box with a warning message. Quits will also be engaged for Inclination, or inclination rate. If a quit is reached, the screen will resemble **Figure 17**:

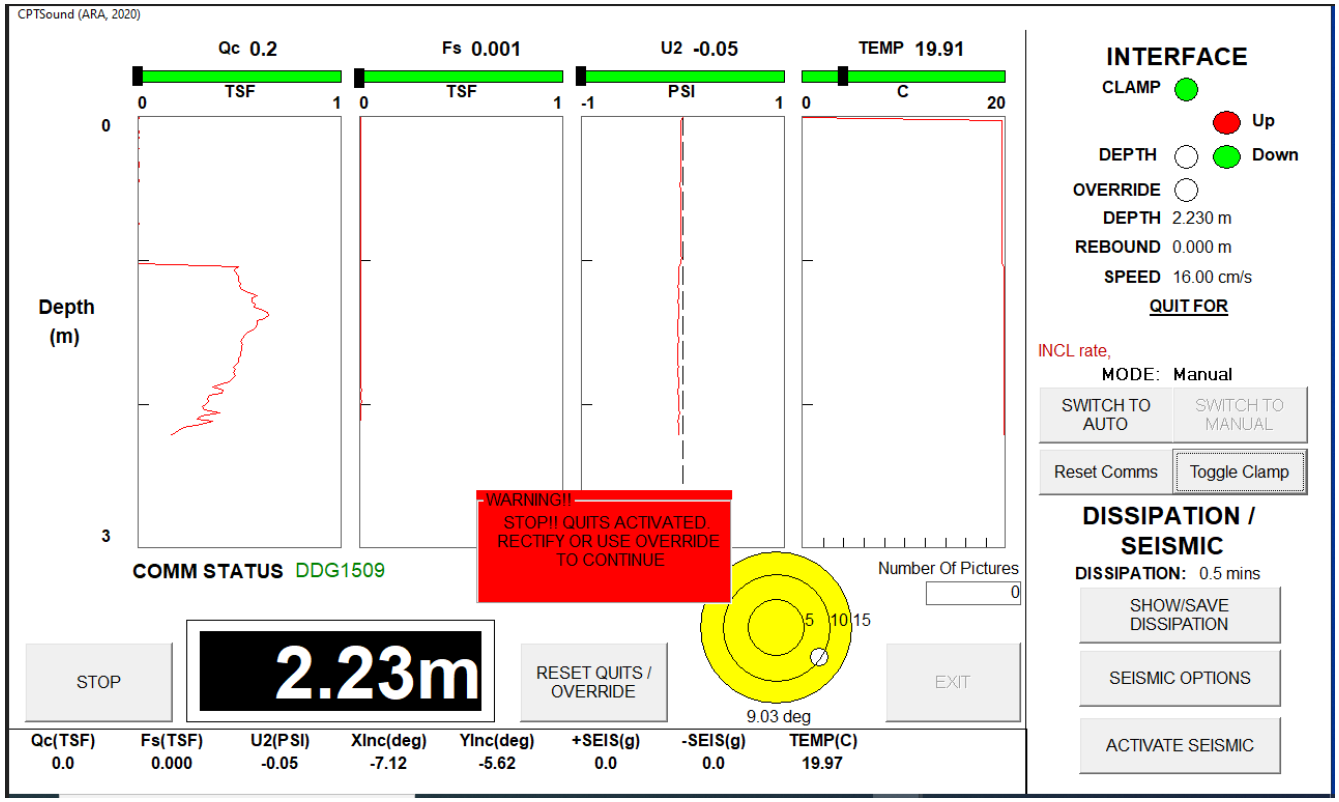


Figure 17 Test in progress with QUIT

As seen above, a quit condition causes the computer to display a red WARNING box, informing the user that a quit condition has been reached, and to turn off the hydraulics so that the user cannot continue, if a solenoid stop is connected to the Truck Interface (port 4). The channel that caused the quit is listed underneath the QUIT FOR header on the right side of the screen. The channel that caused the quit is also highlighted at the bottom of the screen. (see red circles above—this alarm was for X Inclination)

If a quit condition is reached, but the user feels that it is safe to continue, the quit(s) can be over-ridden or reset. If the quit condition has passed, pressing RESET QUITS / OVERRIDE will remove the quit warning and reset the hydraulics. If the quit condition is still there, then pressing and holding down on RESET QUITS / OVERRIDE will override the quit condition, but not remove the warning until the condition has passed. Figure 11 shows what holding down the RESET QUITS / OVERRIDE button will display:

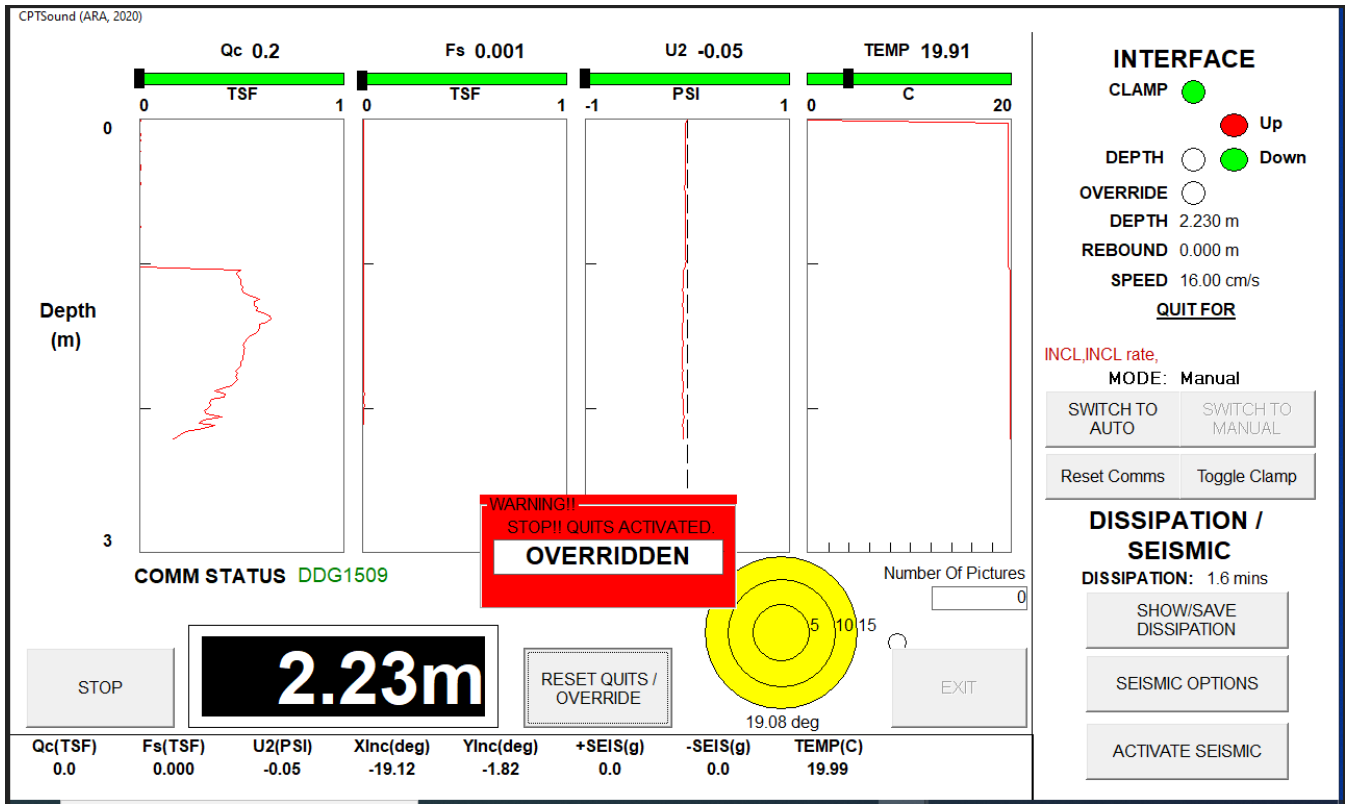


Figure 18 Test with QUIT Overridden

NOTE: Using the RESET QUITS / OVERRIDE button to override the quits can be dangerous. It is recommended that only those users who have enough experience with quit conditions should use this button.

2.2 PERFORMING A DISSIPATION

A dissipation test can be performed anytime during a sounding as long as the cone being used has a pressure transducer, which most cones do.

To perform a dissipation test, advance the cone to the desired depth and stop immediately after the depth is reached. Once the cone stops advancing, **UNCLAMP** to take the pressure off the cone and immediately press **SHOW/SAVE Dissipation,** the computer starts recording the dissipation on the pressure transducer. This brings up the dissipation screen as shown in **Figure 19**.

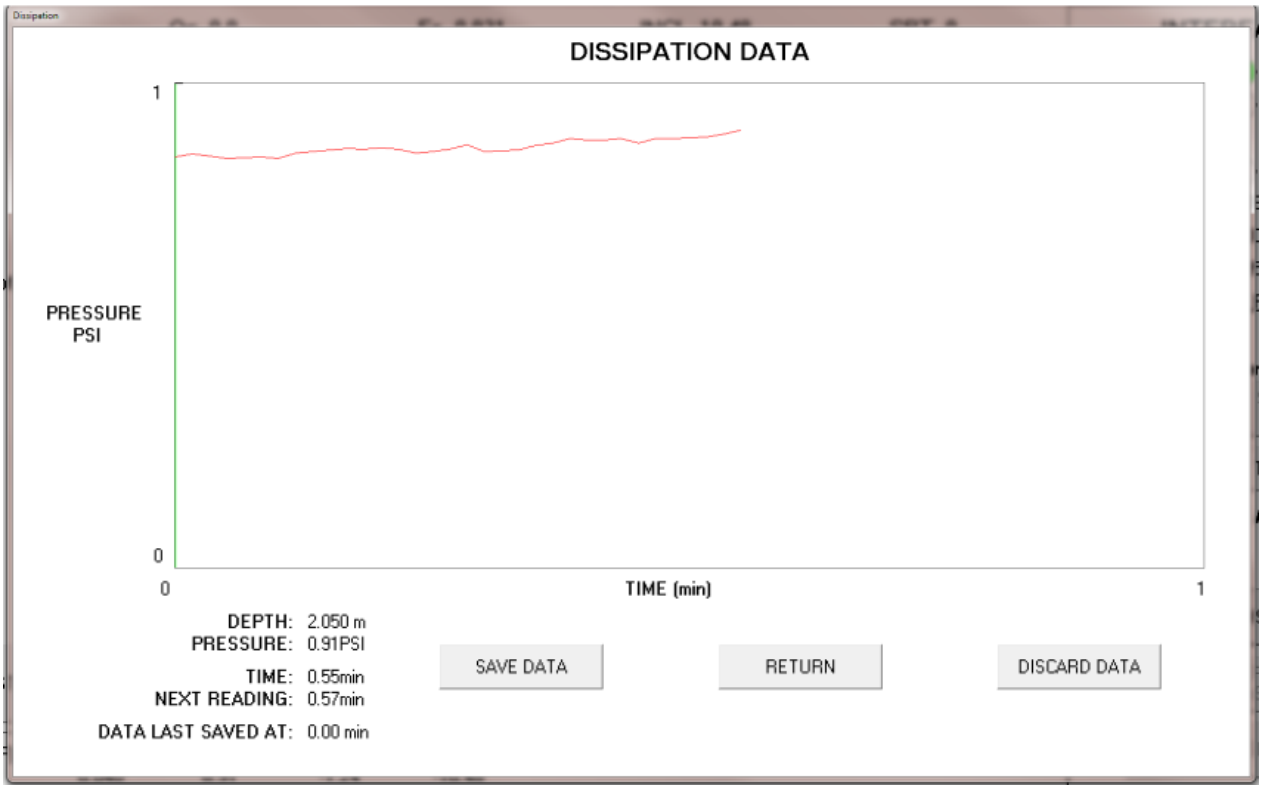


Figure 19 Dissipation Test Running

On this screen, the computer displays the pressure vs. time. With DYNAMIC INTERVAL –NO selected the graph and the recorded file with update each second until the dissipation test is stopped.

With DYNAMIC INTERVAL- YES selected in set up the graph will update every second for the 1st minute, every 5 seconds for the next 4 minutes and every 60 seconds thereafter. The real-time pressure is shown on the lower left comer of the screen along with the current elapsed time, the time to the next reading, and the time at which the data was last saved.

To save the dissipation data, click SAVE DATA. This will save the data up to that point. SAVE DATA

can be clicked again later to save readings that have occurred after SAVE DATA was clicked.

To return to the MAIN SCREEN, click on RETURN. This will return the user to the MAIN SCREEN, but the dissipation test will still be active. It can be viewed again by pressing on the SHOW / SAVE DISSIPATION button. It will not save the data, however. Only SAVE DATA does that.

To stop the test, either click DISCARD DATA or click RETURN and advance the cone. Once the cone has gone about .05 meters, the test will automatically restart.

2.3 STOPPING A SOUNDING

Once the desired sounding depth is reached, a quit condition is reached, or the pushing platform cannot push the cone any further, it is time to stop the test.

To stop the sounding, click on STOP on the MAIN SCREEN. This brings up the following window:

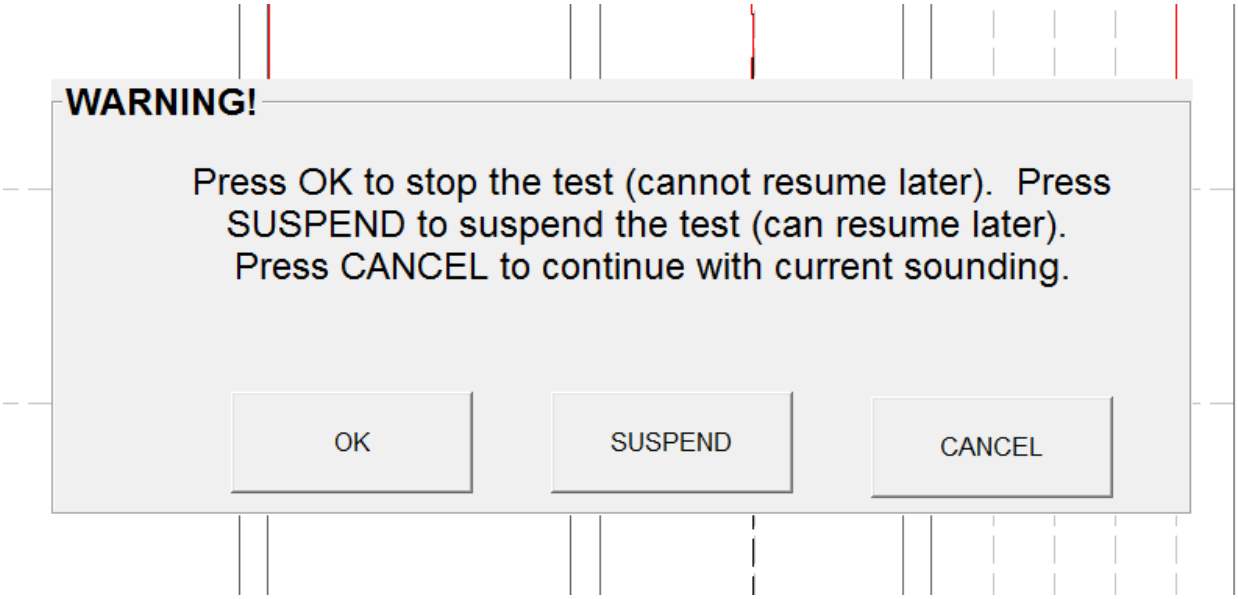


Figure 20 Stopping a sounding

From this window the user can: (1) Stop the sounding by clicking OK, (2) Suspend the sounding by clicking SUSPEND, or (3) return to the sounding by clicking CANCEL.

If the user clicks OK, the computer will ask if he wants to take a final baseline or not. Only take a final baseline if the cone is completely out of the ground. Otherwise, click NO BASELINE,

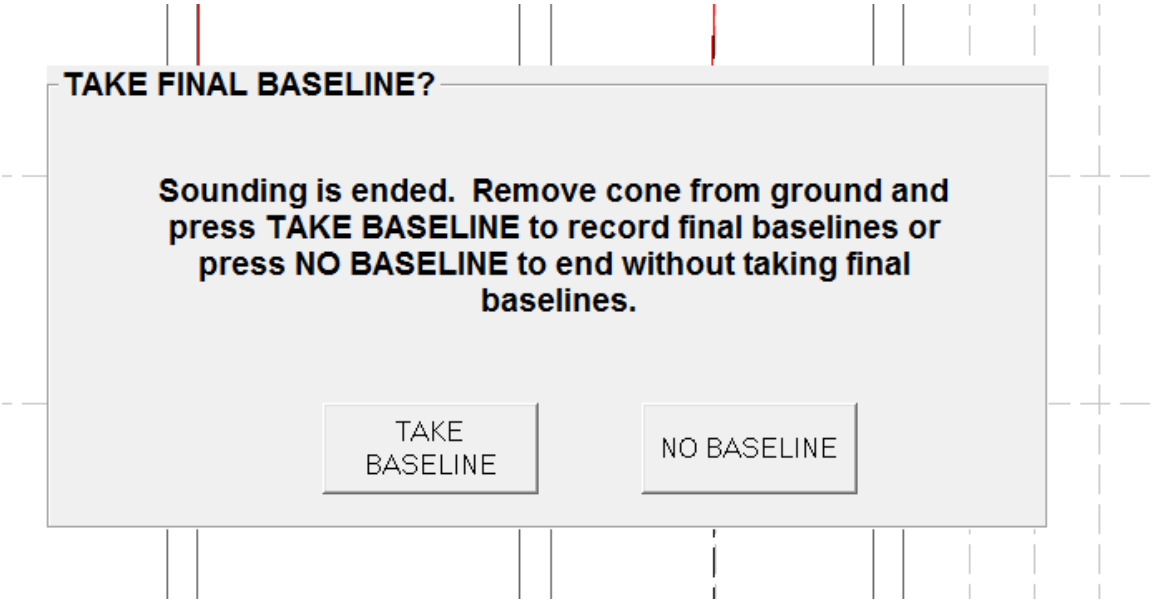


Figure 21 Take Baseline/No Baseline

Once a baseline is taken or not taken, the computer will inform the user that the test is over and return the program to the CPTSND Main Menu.

The sounding is now completed. The results can be viewed using the Vertek ConePlot program

2.4 SUSPENDING A SOUNDING

A sounding can be suspended instead of stopped. To suspend a sounding, click STOP on the main screen. When the next window comes up, press SUSPEND instead of STOP or CANCEL. This will suspend the sounding. The sounding can be resumed, with the same cone, as long as another sounding is not started.

1) RESUMING A SOUNDING

To resume a sounding, start CPTSND by clicking on the Digital Cone Icon. When the OPENING SCREEN appears, press RESUME instead of START. The following screen will appear.

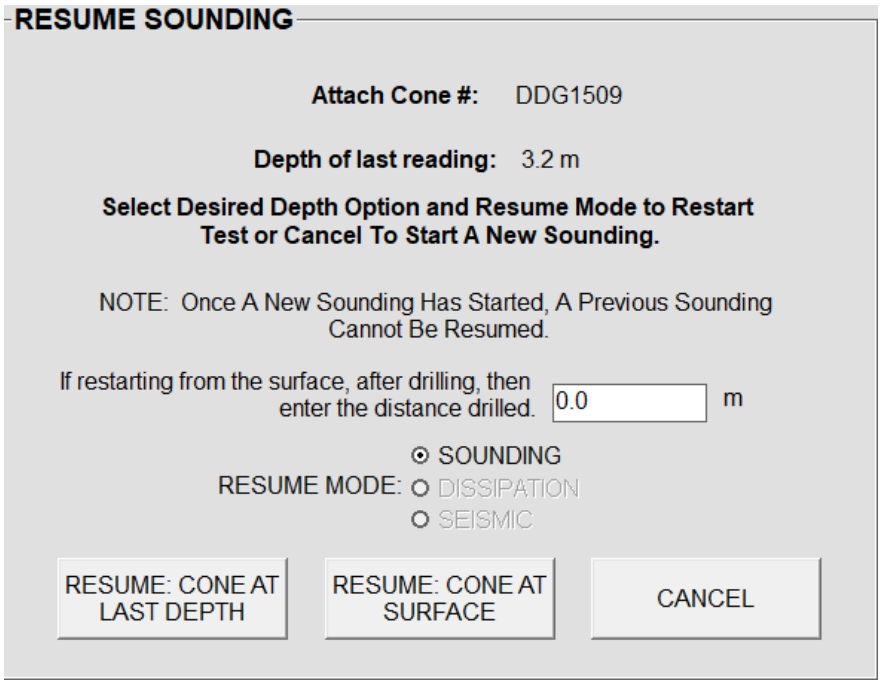


Figure 22 Resume Sounding options

NOTE: The resume function can also be used if the CPTSND program crashes during a sounding.

There are two options on the resume screen: (1) RESUME: CONE AT LAST DEPTH and (2) RESUME: CONE AT SURFACE.

If the cone has not moved since the sounding was suspended or the program crashed, then click on RESUME:

CONE AT LAST DEPTH: This is the option that will be used the most. If the cone was removed from the hole, choose RESUME:

CONE AT SURFACE: This option will help the user to advance the cone back into the ground and restart the sounding at the correct depth. It is also useful if the ground has been drilled (there is a text box where the user can specify how far the soil was drilled).

Once one of the two resume buttons has been clicked, the computer will look for the cone and display the CONE SETTINGS screen. If another cone has been attached, the computer will not allow the user to resume the sounding.

Click CLOSE on the CONE SETTINGS screen. The program will go straight to the MAIN SCREEN and resume the sounding. There is no need to click TAKE BASELINE or START.

SECTION 3.0 SEISMIC TESTING

If the system has been setup to perform seismic tests and a seismic cone is attached, then seismic tests can be performed during the sounding. The operation of the seismic module is described here, separate from the rest of the program, due to the fact that it is not standard to the system.

3.1 PHYSICAL SETUP

Before starting a sounding, it is necessary to setup the cone, the seismic trigger box and the strike plate(s).

(**Note**: Much of the below instruction is for the older "wired hammer" method. If you have the newer trigger blocks they simply plug into the truck interface and react to the vibration of the strike when properly mounted to a strike plate. The other instructions are valid for either style of triggering)

The cone needs to be oriented before the test so that the seismic sensor is oriented towards the strike plate(s) while it is pushed. If there is more than one strike plate, then orient the cone towards one of the strike plates. If the orientation of the seismic sensor is not readily apparent, remove the tip and friction sleeve assembly to expose the strain gages. On the step between the strain gages, which are covered with electrical tape on older cones, and green epoxy on newer ones there should be a circle with a cross in it. This indicates the orientation of the seismic sensor. Mark the orientation on the collar and put the tip and sleeve assembly back on. TIP: Once the orientation is known, take a file and mark an X on the collar. This will remove the necessity of removing the tip and sleeve on every hole to determine the orientation.

If it is not already connected, connect the trigger box to port **#3** on the interface box) using the supplied cable(the same box the depth counter, head-load/pressure, and solenoid are plugged into. Place the box close to strike plate and out of the way, so that it does not get damaged. Also, place the box on a *dry* surface so that water does not get into the box.

NOTE: If the interface has been installed at Vertek, the trigger box will have already been permanently attached to the pushing platform and does not need to be manually placed as described above.

The strike plate(s) must be positioned so that they are secure and will impart the maximum amount of shear wave force to the seismic sensor. The best place to put the strike plates is underneath the leveling jacks that are closest to the hole. When the leveling jacks are advanced downward, they will secure the strike plates in position. The strike plates can be made of wood blocks with L shaped metal brackets bolted to them, or they can be made of square metal tubing. Whatever is used, it must be capable withstanding the maximum amount of pulling force expected and large enough so that the leveling jack does not slip during the push. If the strike plate fails, the rods can be bent or the cable can be cut.

NOTE: If a Vertek 20-ton truck is used, the one piece front leveling jack assembly makes an excellent

strike plate. If a 20-ton truck is not used, DO NOT USE the leveling jacks as strike plates. This may damage the jacks.

If a strike plate is used that is not part of the pushing platform (and therefore electrically connected to it), it must be manually connected to the system electrical ground. On the seismic trigger box, there are two banana jacks. The black banana jack is connected to the system ground. A grounding cable is supplied with the system. The grounding cable has a banana plug on one end and an alligator clip on the other end. Connect one end of the grounding cable to the black banana jack on the trigger box and the other end to the strike plate.

It is not necessary to plug the hammer into the trigger box at this time. In fact, it is not desirable to plug the hammer into the box until a strike is ready to be performed.

With the strike plates and cone setup correctly, start the test as described above. There are no changes to the program.

3.2 PERFORMING A SEISMIC TEST

NOTE: For the purposes of this section, it is assumed that a sounding is in progress.

It is recommended to check the SEISMIC OPTIONS prior to beginning the test.

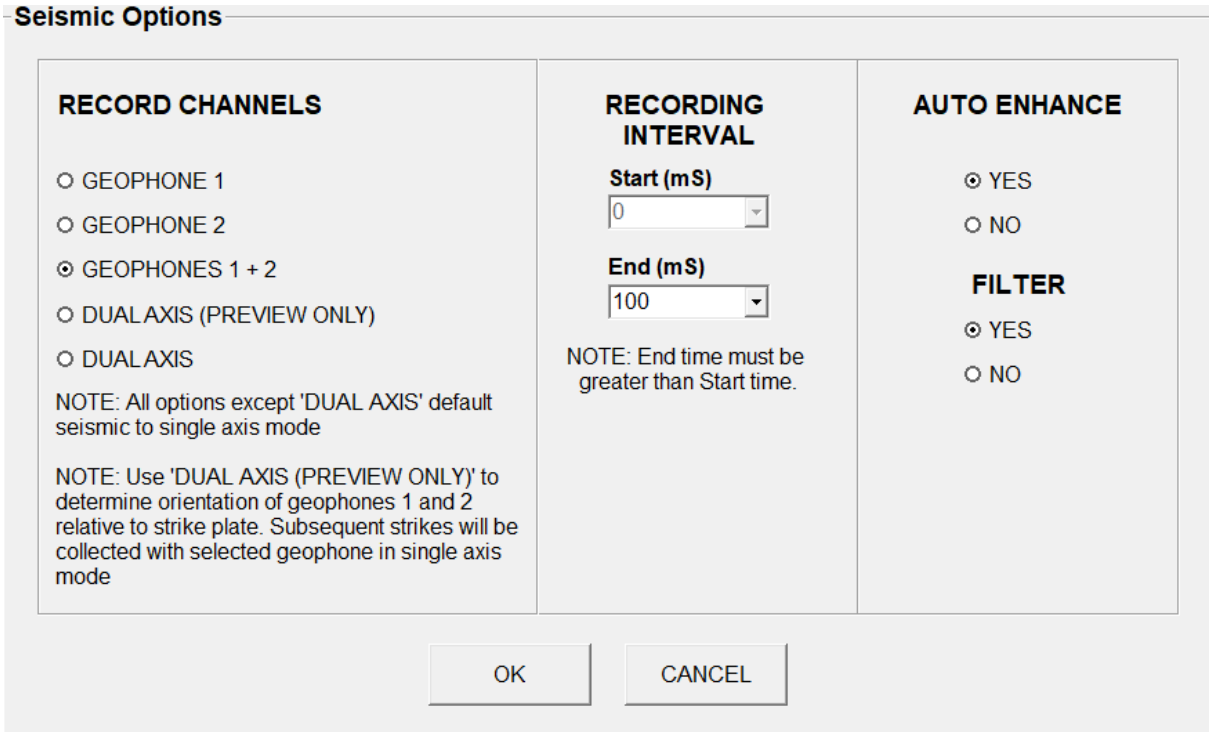


Figure 23 Seismic Options

On the left side of the screen are the **RECORD CHANNEL** options for choosing the cone geophones to record for the test. The most common (recommended) choice is to select Dual Axis (Preview Only). This option will display both geophone results on the first strike and allow the user to choose the geophone with the best result (alignment). This selected geophone will then be used for all strikes for the entire test. This provides the best results when using two strikes at each depth (an A strike from one side of the rig; and a B strike from the other side)

Note that all options will result in single geophone use except for the DUAL AXIS mode. DUAL AXIS will display two waves from one strike (one from each geophone). It is recommended to make only one strike at each depth in Dual Axis mode.

NOTE: When using a DPG (P Wave) enabled cone the options are different

The RECORDING INTERVAL sets the window of time for the system to record the selected geophone(s) after the trigger signal is detected. For deeper tests, and in softer materials, it will be necessary to adjust this end time to allow the arrival wave to be captured. This can be done at the beginning of tests or as the arrival wave moves toward the right side of the screen as the test proceeds. This can be set up to 1 second. Vertek recommends that the start time be left at 0 for standard testing.

AUTO ENHANCE and FILTER choices here are the same as this choice in beginning setup but here offers the opportunity to turn them on or off at different depths. (normally these are best used for deeper tests as the signal strength starts to diminish).

To start a seismic test, advance the cone to the desired depth and click on ACTIVATE SEISMIC. The following window will appear on the main screen:

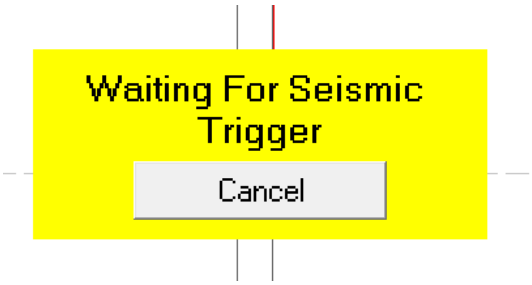


Figure 24 Waiting for Trigger

NOTE: Before clicking ACTIVATE SEISMIC, make sure that the seismic hammer is OFF of the ground or is not plugged in. If it is on the ground, there is a possibility that the seismic channel will activate prematurely. This can cause the program to lock up.

The cone and the program is now ready for the hammer strike. Plug the hammer into the trigger box, if it is not already plugged in. Then, swing the hammer against the strike plate. When the hammer is struck against the plate, it will complete the circuit and the cone will start recording the seismic data.

If the Waiting For Seismic Trigger screen does not disappear when the hammer is struck, check the connections. Make sure that the hammer is plugged in and that the strike plate is grounded. Also, check the connection of the trigger box to the interface box.

If any of the connections are incorrect, fix the condition and strike the hammer again. If the screen does not disappear, press Cancel and activate seismic again. If the screen still does not disappear, make sure that the hammer is not left on the ground or laying on any metal that is connected to the pushing platform when ACTIVATE SEISMIC is clicked. If the ground is wet, it can prematurely trigger the seismic channel. This will give the screen below.

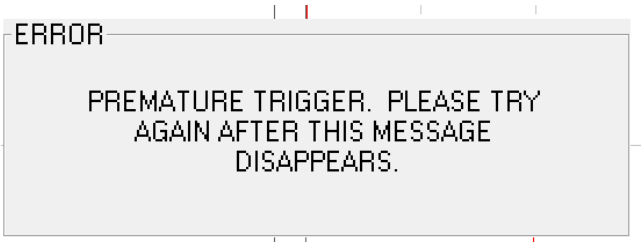


Figure 25 Error screen

If the short persists the following screen will appear. Check all cables and connections as necessary to clear the problem.

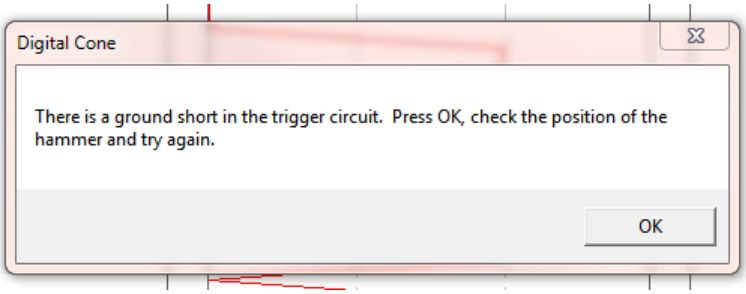


Figure 26 Seismic Trigger issue

Premature triggers can also be caused by shorted trigger boxes, cables, or a shorted cone cable.

NOTE: If the seismic channel prematurely triggers due to-the hammer being left on wet ground or on a metal portion of the pushing platform, there is a possibility of the program locking up and not responding.

If this is the case, press CTRL-ALT-DEL to end the program and then use the RESUME function to go back into the program.

If the hammer strike is successful, the following screen will appear:

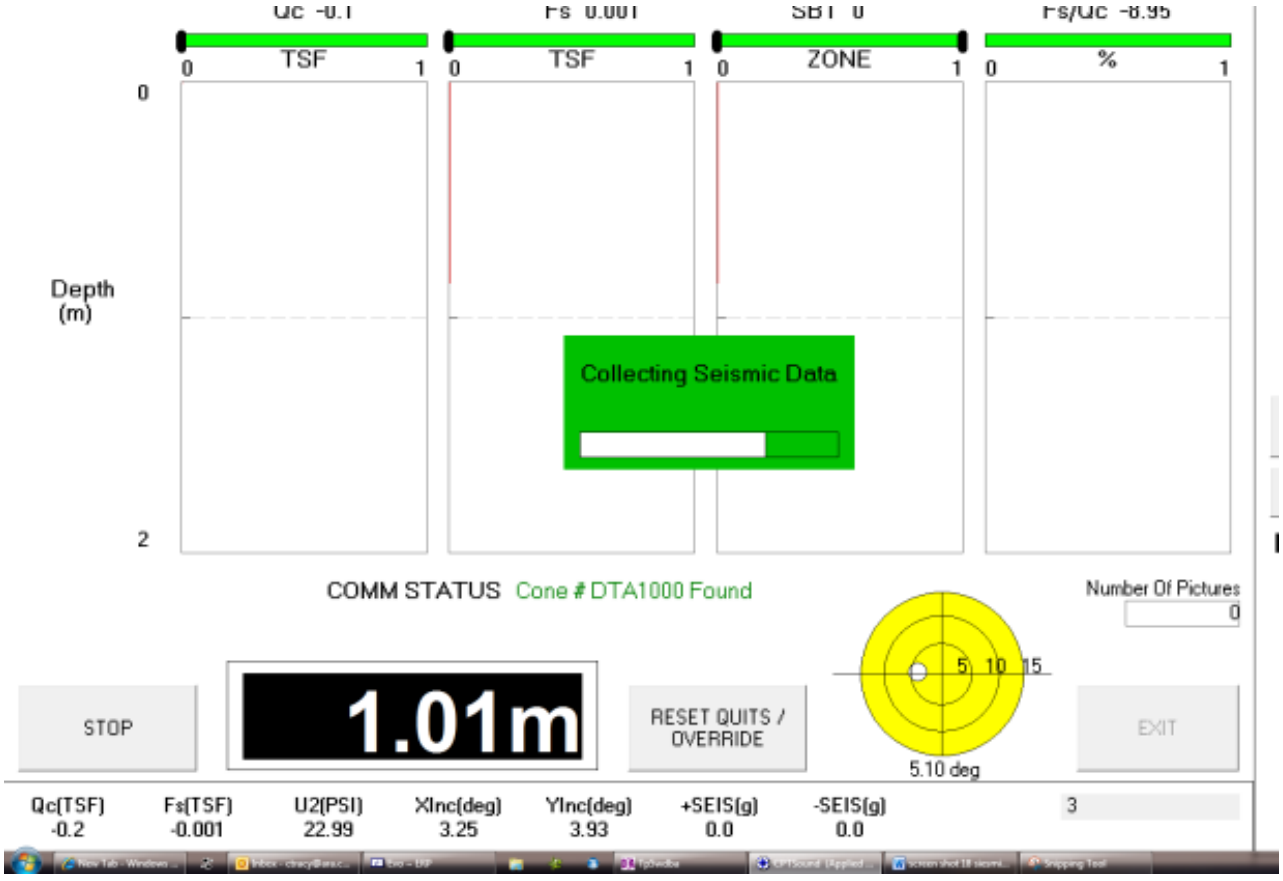


Figure 27 Collecting Seismic Data indication

The cone is now transmitting the data to the program. The bar graph shows the progress of the data transmission. When the data transmission is finished, the window will close and the seismic data display window will appear with the data graph.

NOTE: a DDG –dual shearwave—cone was used in this example and Dual Axis Preview was selected**:**

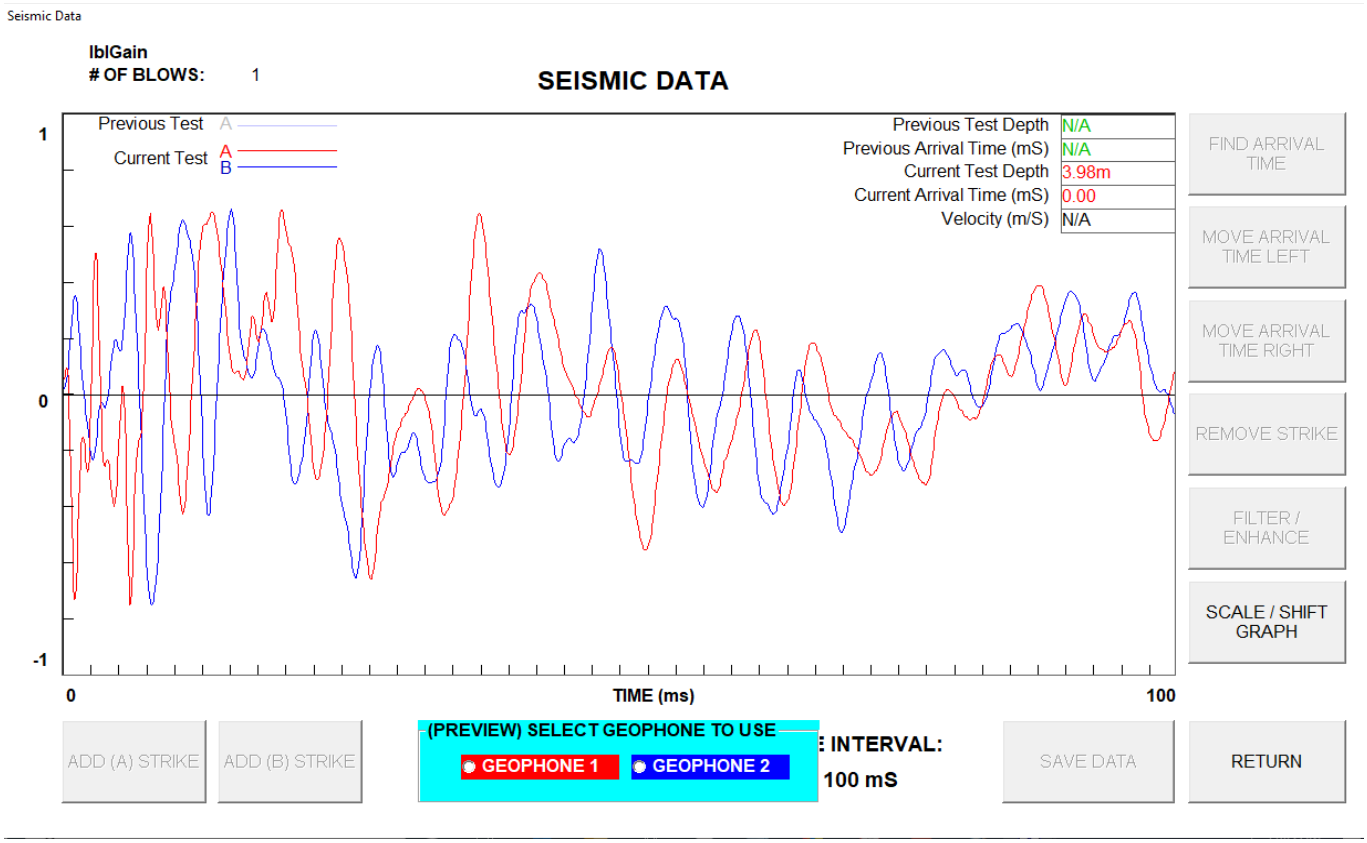


Figure 28 Dual Axis Preview screen

Note: All screen shots in this manual are from bench testing and the seismic waves do not necessarily depict actual results

In this case since the two waves are similar we chose geophone 1. This now becomes the default geophone for this test. Should the arrival wave not have good definition it would be recommended to try again until the wave is satisfactory.

It may be necessary to turn the cone (***clockwise only***) to get better alignment. This screen shows the graph after selecting the geophone. At this point you can ADD an A Strike (being sure to strike from the same place as previous as this will add data to [clean up and enhance] the chosen geophone wave)

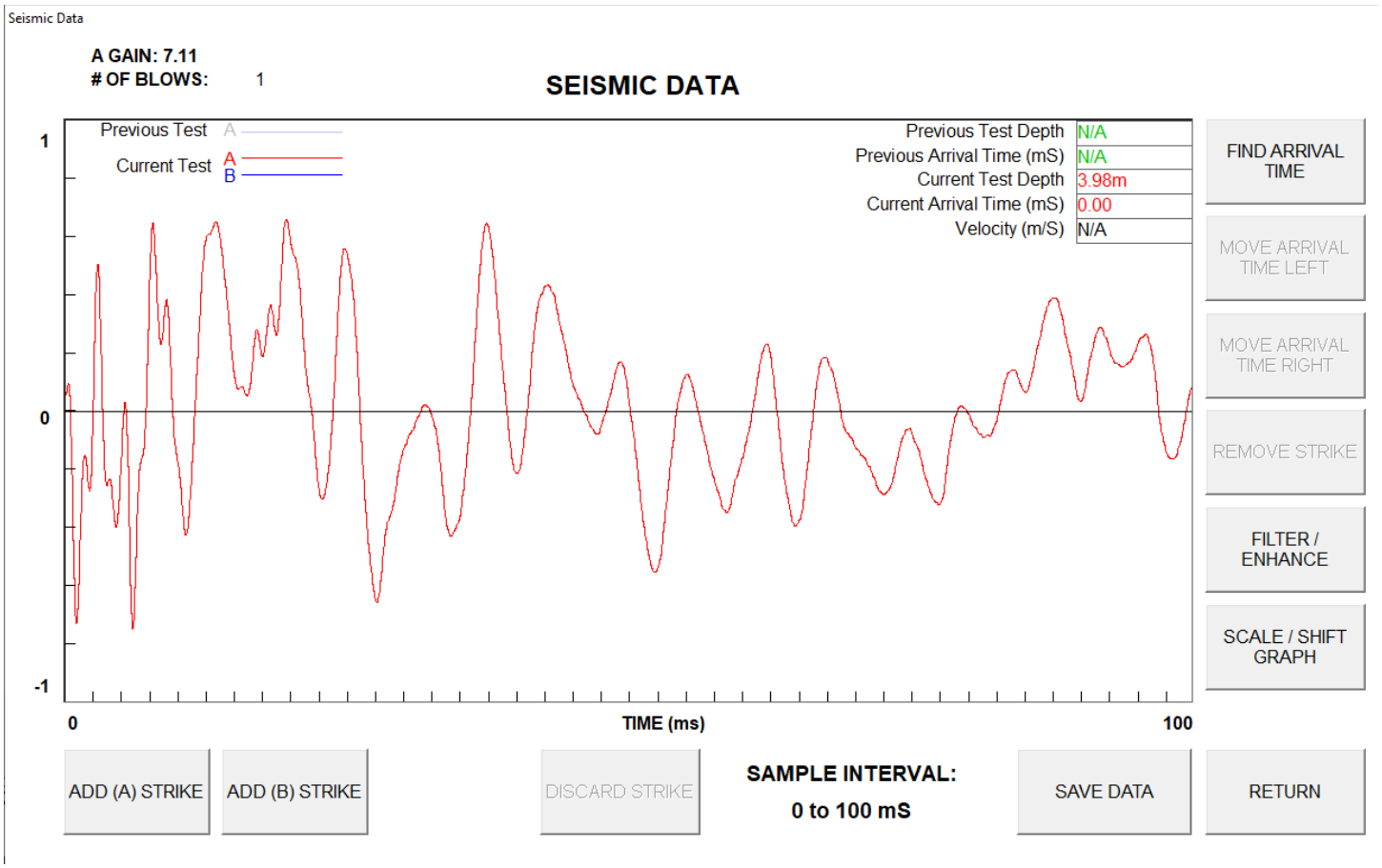


Figure 29 A Strike selected

Adding a B STRIKE from the other side of the rig

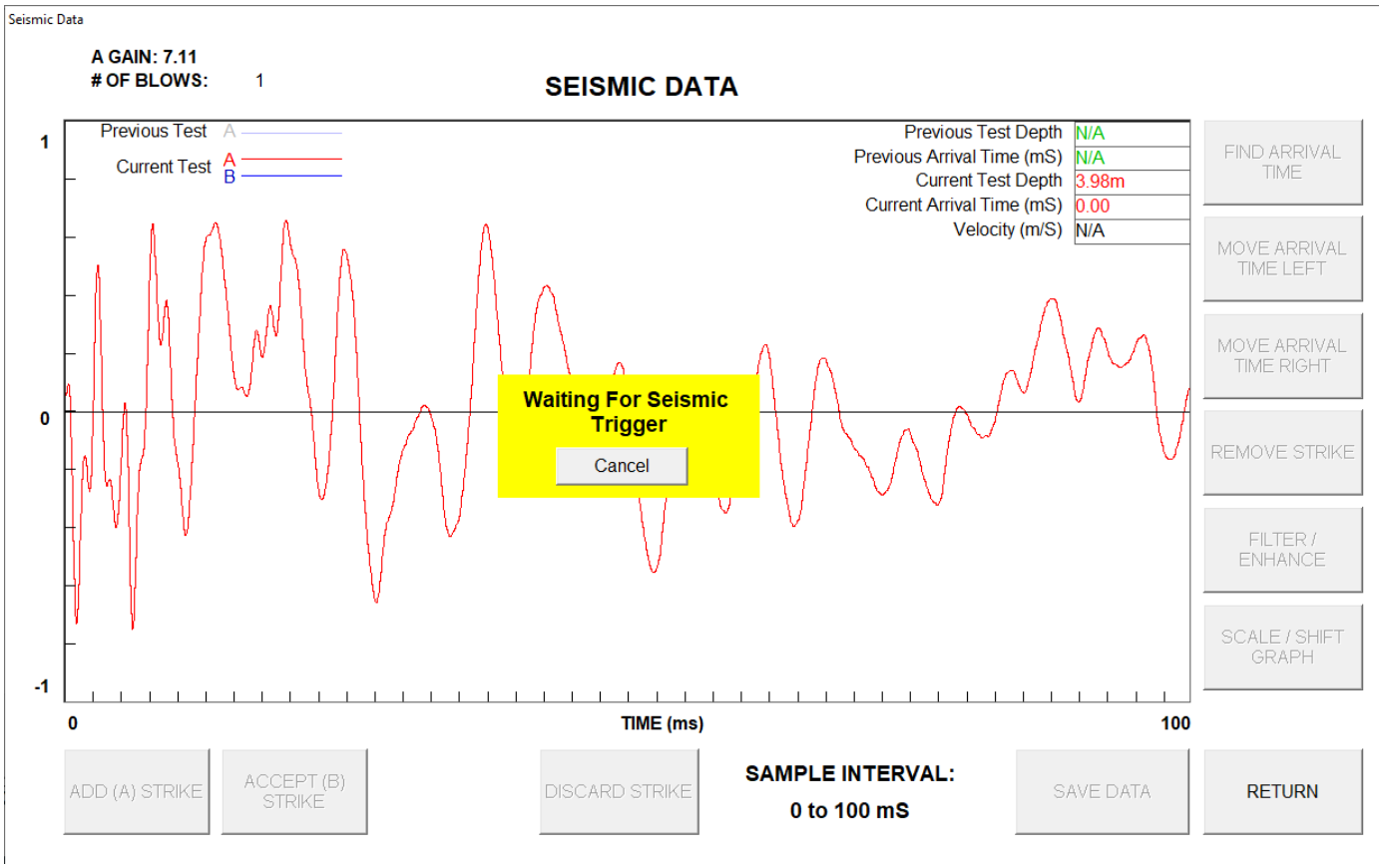


Figure 30 Waiting for trigger for B Strike

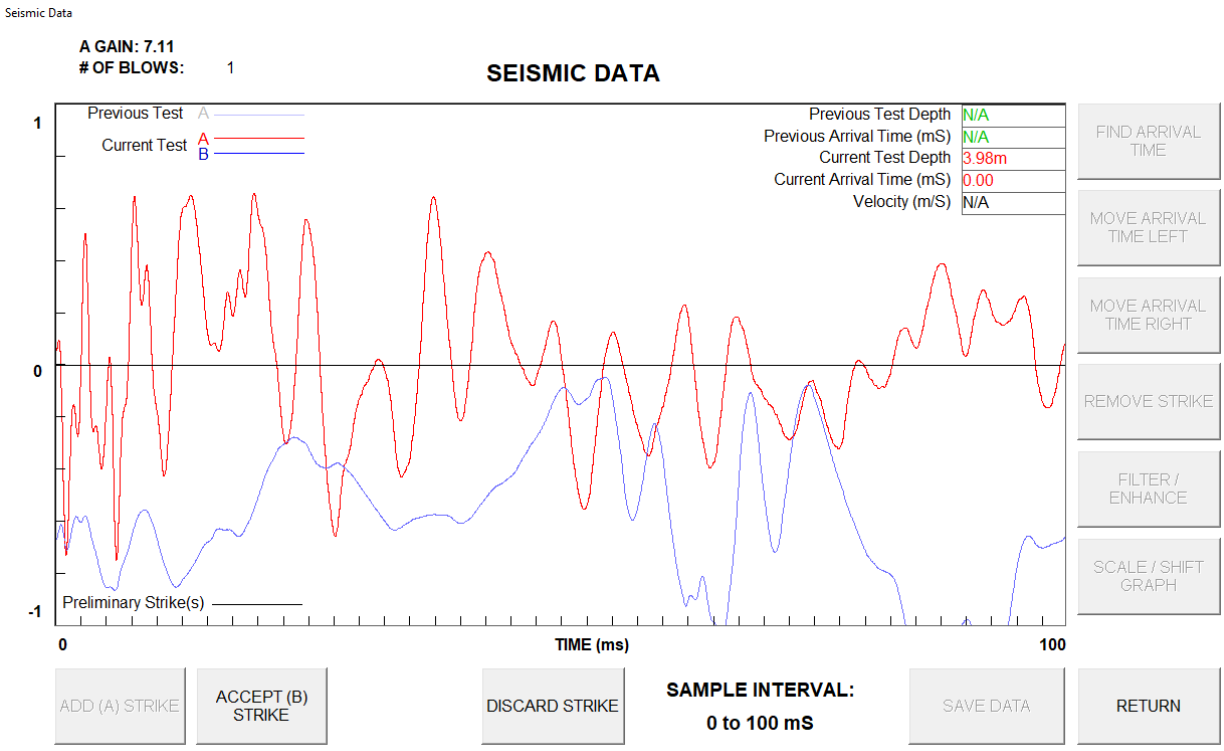


Figure 31 B Strike not satisfactory

Above picture shows an addition of the B strike where the physical strike was faulty. If this happens simply click on DISCARD STRIKE and try again.

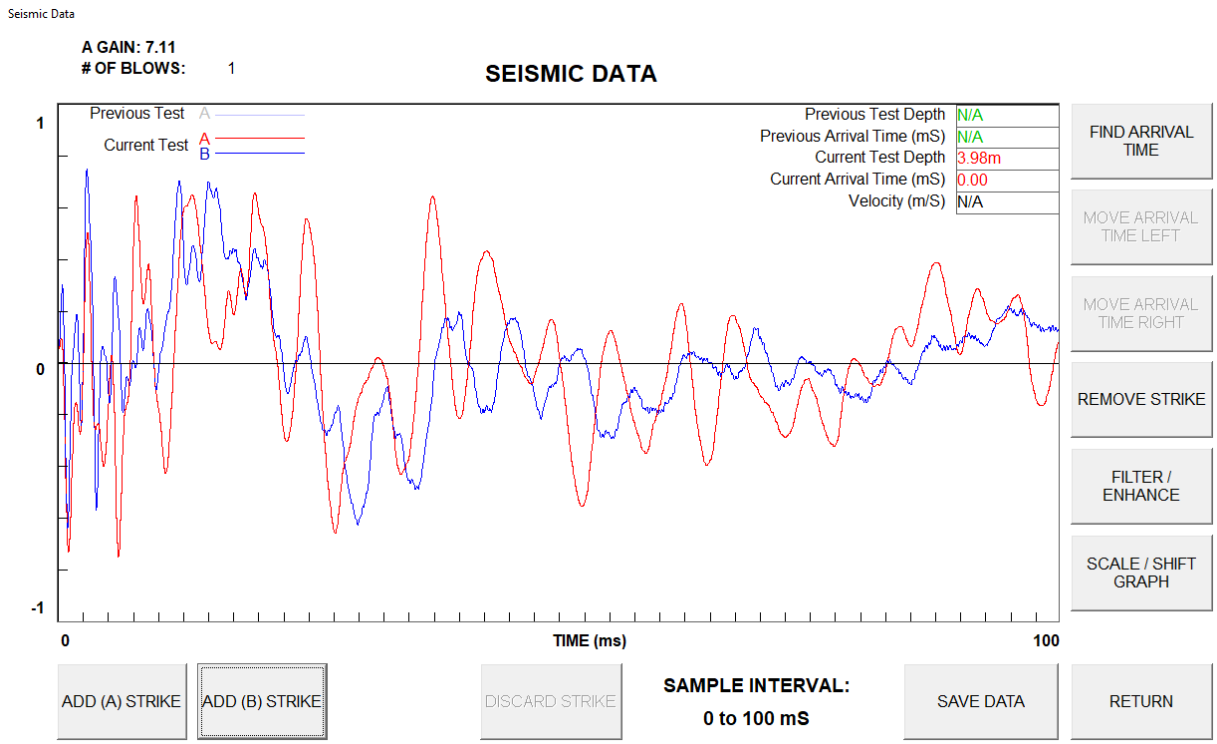


Figure 32 A & B Strike to save

When satisfied with the appearance simply hit SAVE DATA and RETURN. This will return you to the CPT main testing screen where you can advance the cone to the depth of the next seismic test.

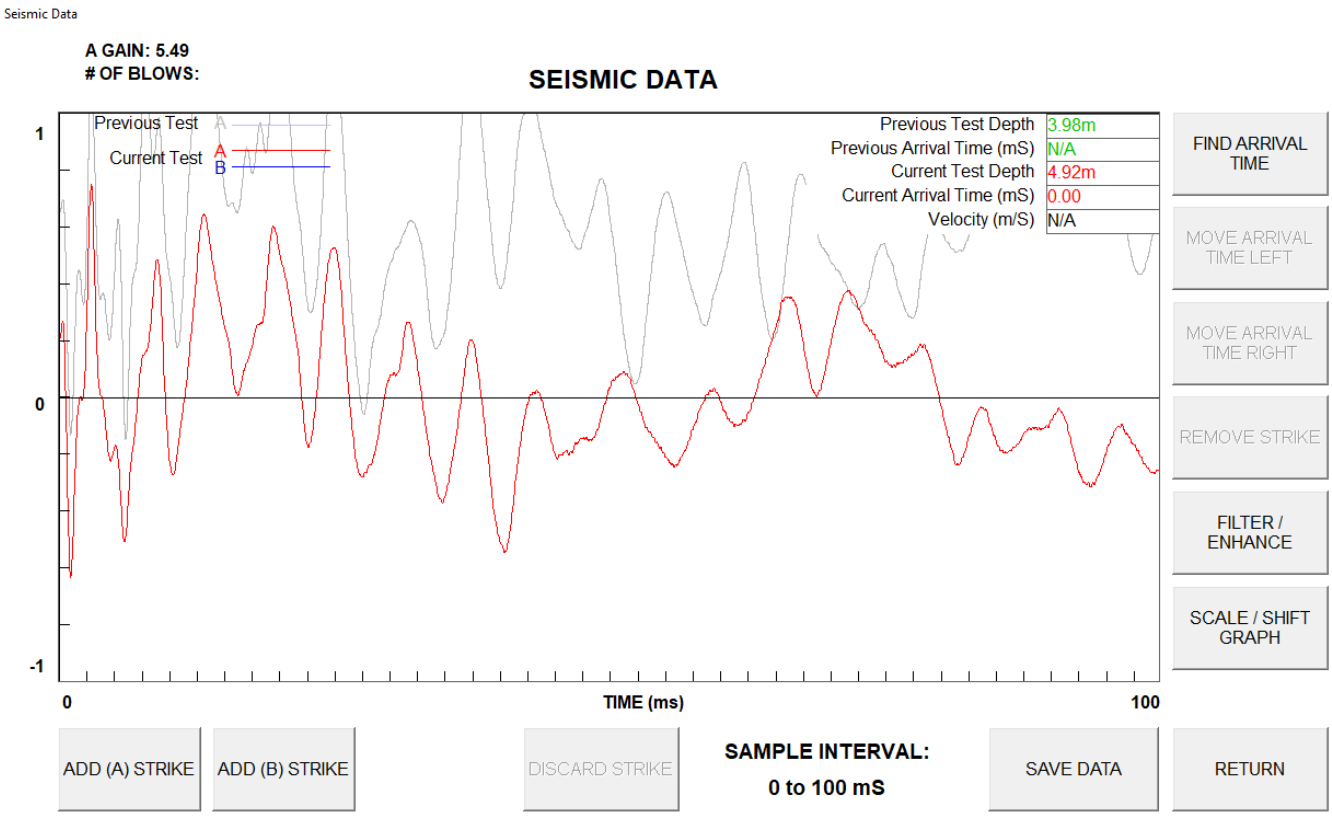


Figure 33 A Strike at second depth

This screen shows the A strike at the second depth (be sure that all the A strikes in a given test are done from the same side of the rig to ensure accurate data processing after completion).

Note: that the previous depth strike has been grayed out and moved up.

This is done so as you are moving deeper into the test you can monitor the appearance of the arrival waves. Ideally the wave will gradually move to the right as it takes a little longer at each depth for the wave to arrive. Once the wave starts getting close to the right edge be sure to increase the INTERVAL so the data is not lost.

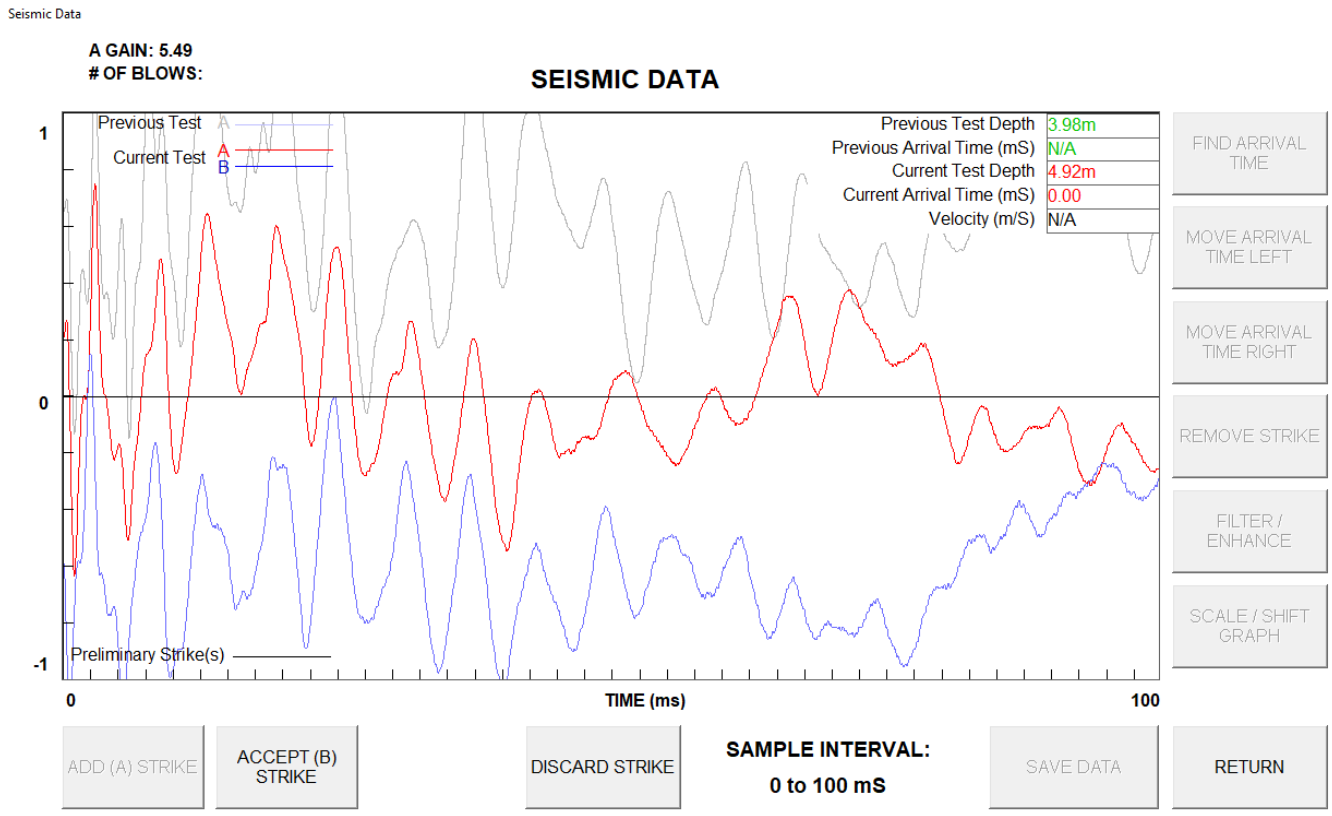


Figure 34 B Strike at second depth

This screen shows the B Strike on the second depth ready to ACCEPT or Discard. Click ACCEPT if wave is satisfactory or DISCARD to re-try. The next screen shows the strike accepted and ready to SAVE DAT and RETURN to sounding.

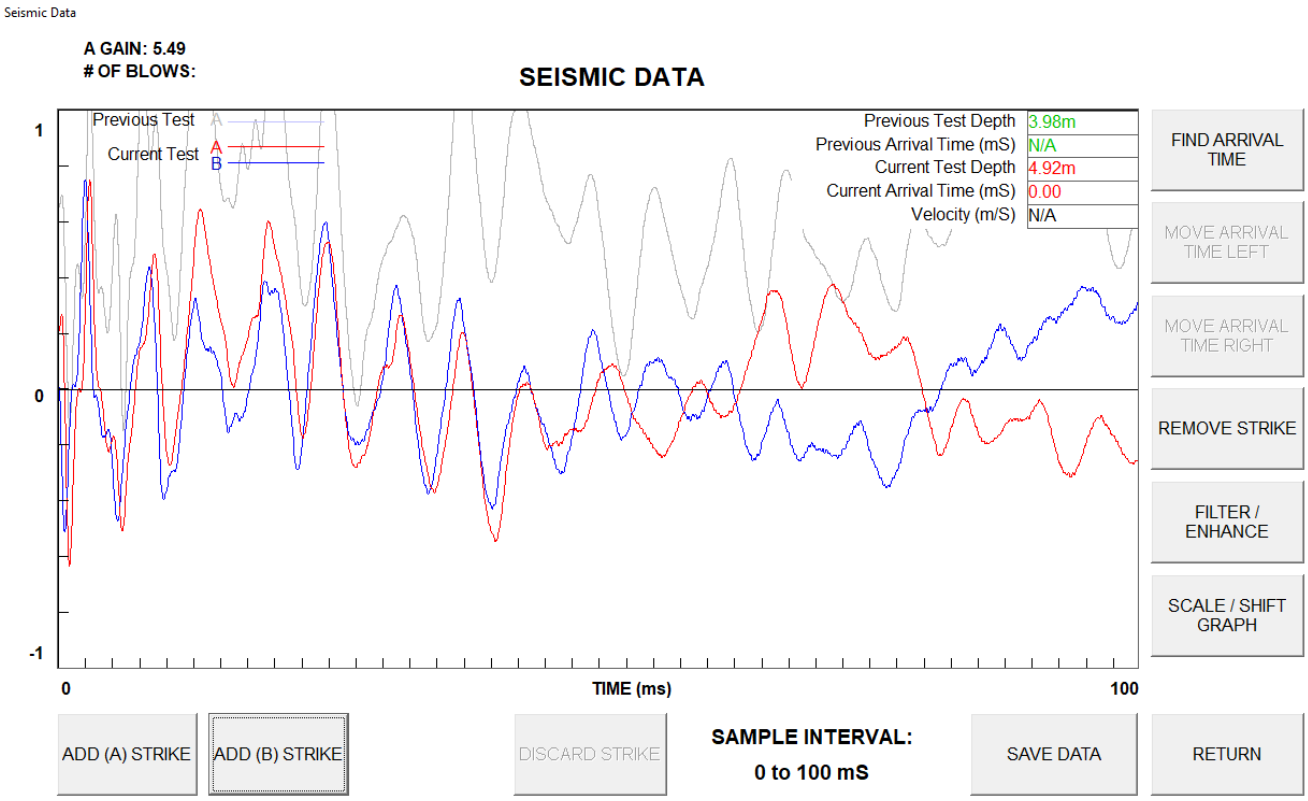


Figure 35 A & B Strikes second depth ready to save

Continue CPT test including seismic test at selected depths until complete. The Seismic results are saved in a file with the same name as the sounding but with an *.smc file extension.

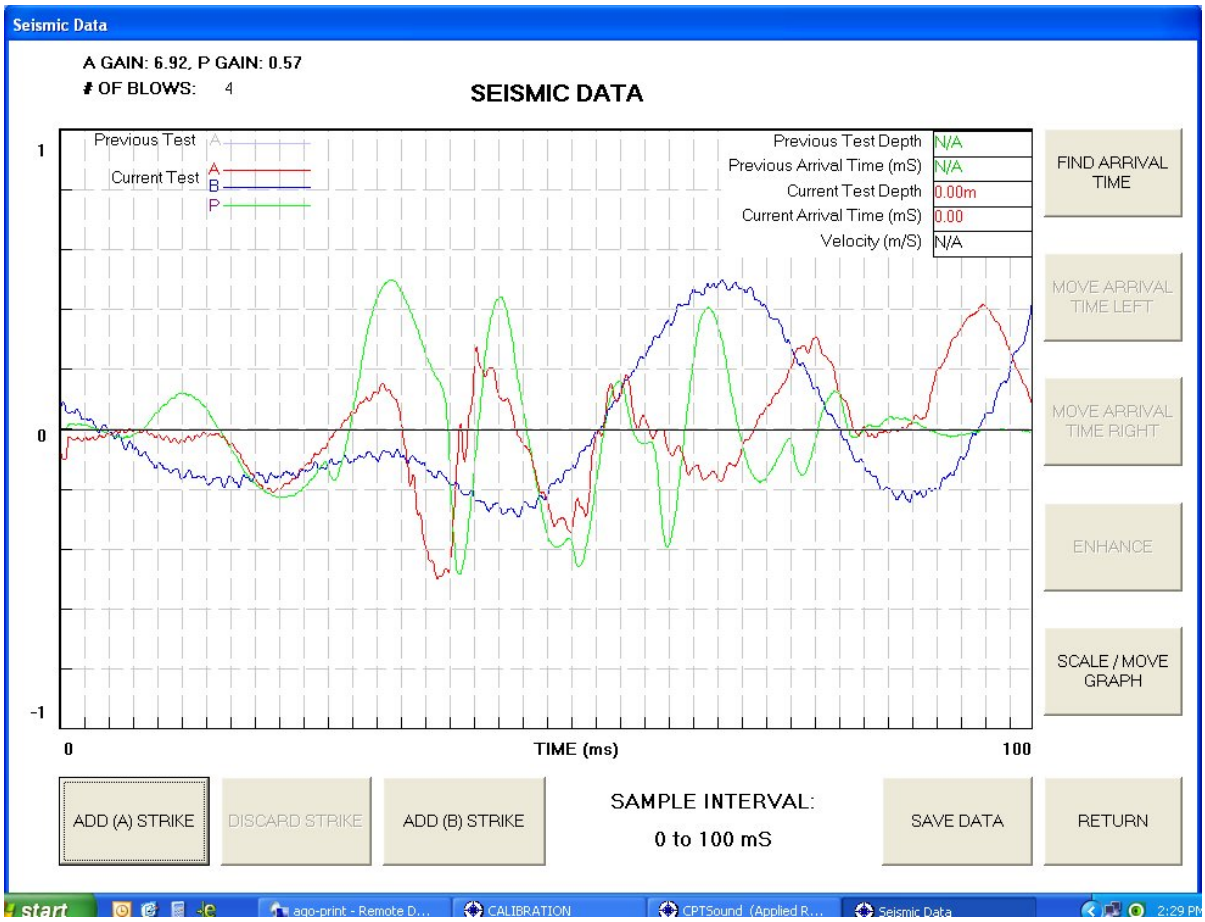


Figure 36 Seismic results USING PWave enabled cone

This screen shows a result possible when using a DPG cone. This has one geophone for shear (S) waves and one geophone for compression (P) waves. To achieve this result the test was done with an A strike from one side, then a B strike from the other side. Then a third strike for the P wave result. For optimal Pwaves, use a different strike plate configured to drive the wave down as the hammer swings down onto the P strike plate.

3.3 FINDING ARRIVAL TIME

Arrival times can be chosen during the SCPTu test, it is recommended to only choose arrival times during processing the data in CONEPLOT. This allows for review of all the strikes in the test to determine the best wave section to use for arrivals and to allow consistently applying that point to all the different depths results.

To find an arrival time in CPTSND, click on FIND ARRIVAL TIME. When the button is clicked, the seismic screen will prompt the user to click on the graph near the arrival time:

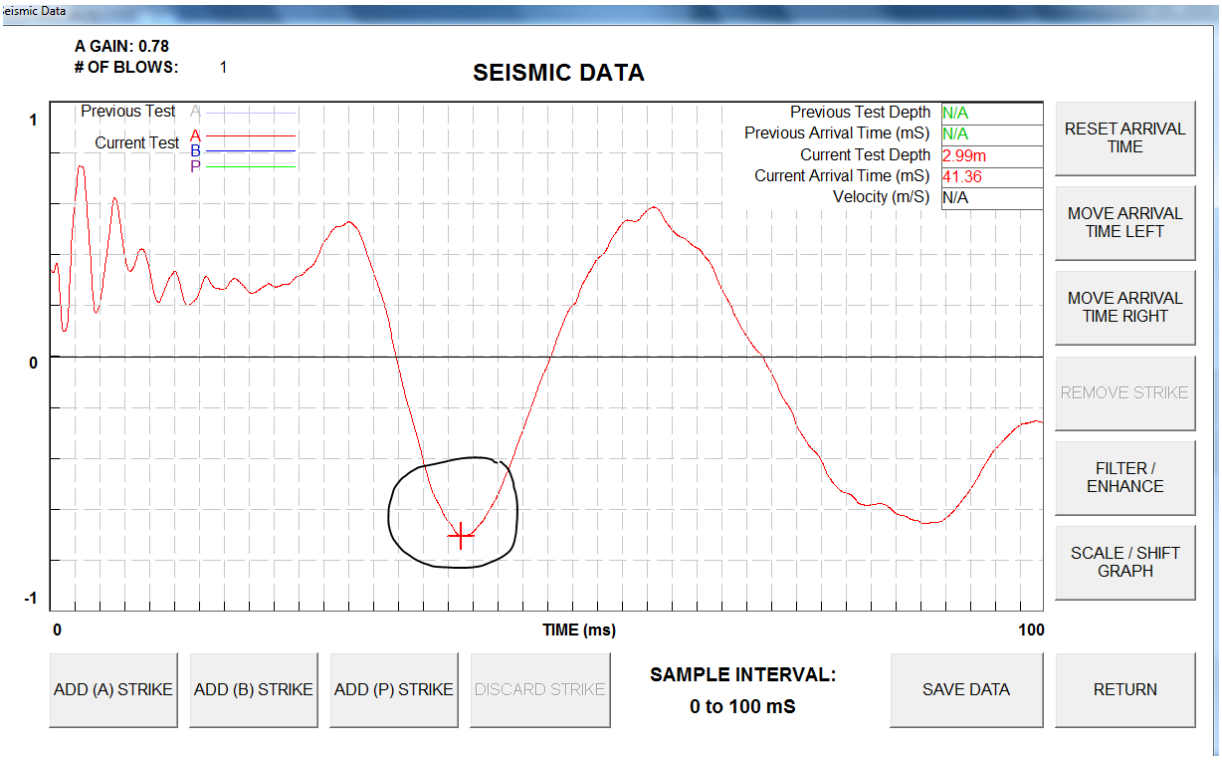


Figure 37 Choosing arrival time

Click on the graph near the arrival time. A cross-hair will appear on the waveform. Use the MOVE ARRIVAL TIME LEFT and MOVE ARRIVAL TIME RIGHT buttons for fine placement of the cross-hair.

Click on SAVE DATA when the arrival time is determined.

SCALING OR MOVING THE GRAPH

To scale or move the graph, click on the SCALE/MOVE GRAPH button. The following window will appear:

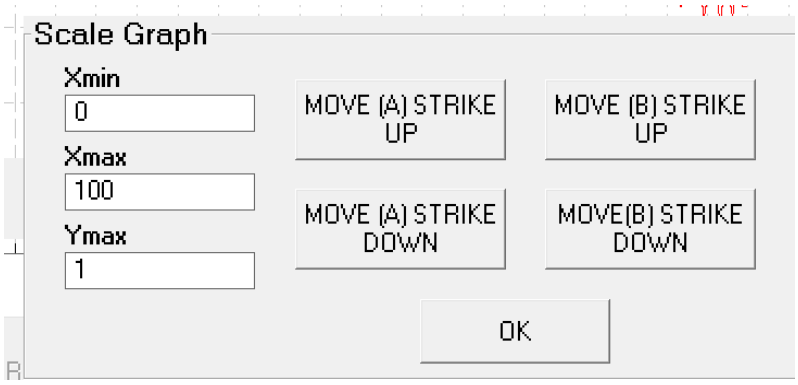


Figure 38 Scaling the Seismic wave

The graph can be scaled to make it easier to pick the arrival time. Change the values in Xmin/Xmax/Ymax to change the scale of the graph.

The **(A)** and (B) strikes can be individually moved up or down. The purpose of these buttons is to allow the user to manually center the waveform(s).

After making the changes, press OK to return to the Seismic Screen. NOTE: The scaling is not saved when the seismic data is saved, but the change made to the waveform(s) vertical position(s) is.